SHOUT
SHARE
IT

1. 9. 64

SBM.
1010

B. M. A. O.

BULLETIN OF
THE BRITISH MUSEUM
(NATURAL HISTORY)

BOTANY
VOL. 2
1955–1962

BRITISH MUSEUM
6 DEC 1962
NATURAL HISTORY

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM (NATURAL HISTORY)
LONDON: 1962

DATES OF PUBLICATION OF THE PARTS

No. 1,	November 1955
No. 2,	December 1955
No. 3,	October 1956
No. 4,	March 1958
No. 5,	February 1960
No. 6,	May 1960
No. 7,	June 1960
No. 8,	July 1960
No. 9,	November 1960
No. 10,	February 1961
No. 11,	September 1962
No. 12,	November 1962
Supplementary Note,	November 1962
Contents and Index,	November 1962

PRINTED IN
GREAT BRITAIN
AT THE
BARTHOLOMEW PRESS
DORKING
BY
ADLARD AND SON, LTD.

BRITISH MUSEUM
6 DEC 1962
NATURAL HISTORY

CONTENTS

BOTANY VOLUME 2

PAGE

No. 1. New Himalayan species of *Pedicularis*. By P. C. TSOONG 1
No. 2. Mosses of Dominica, British West Indies. By EDWIN B. BARTRAM 37
Mosses of the Ecuadorian Andes collected by P. R. Bell. By EDWIN B. BARTRAM 51
No. 3. Novitates Himalaicae—I 65
No. 4. *Saxifraga* of the Himalaya I. Section *Kabschia*. By HARRY SMITH 83
No. 5. The Polypodiaceae and Grammitidaceae of Ceylon. By W. A. SLEDGE 131
No. 6. *Allium* and *Milula* in the central and eastern Himalaya. By WILLIAM T. STEARN 159
No. 7. The identity of *Isopyrum aquilegioides* L. By GAVIN DE BEER and WILLIAM T. STEARN 193
No. 8. On the geographical relationships of the angiosperm flora of New Guinea. By RONALD GOOD 203
No. 9. *Saxifraga* of the Himalaya II. Some new species. By HARRY SMITH 227
No. 10. New species of *Taraxacum* from the Himalayan region. By J. L. VAN SOEST 261
No. 11. The Athyrioid ferns of Ceylon. By W. A. SLEDGE 275
No. 12. The genus *Epilobium* in the Himalayan region. By P. H. RAVEN 325
Supplementary note on P. C. Tsoong's "New Himalayan species of *Pedicularis*". By J. E. DANDY 383
Index to Volume 2 385

hurian kufs.
made
per 8/67.

§

14 NOV 1955

NEW HIMALAYAN SPECIES OF *PEDICULARIS*

P. C. TSOONG

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 1
LONDON: 1955

NEW HIMALAYAN SPECIES OF *PEDICULARIS*
WITH SPECIAL REFERENCE TO THOSE FROM THE EASTERN HIMALAYA

BY

P. C. TSOONG

(Academia Sinica, Peking)

Pp. 1–34

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 1
LONDON : 1955

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

Parts will appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, *No.* 1 *of the Botanical series.*

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issue November, 1955 *Price Eight Shillings*

NEW HIMALAYAN SPECIES OF *PEDICULARIS*
WITH SPECIAL REFERENCE TO THOSE FROM THE EASTERN HIMALAYA

By P. C. TSOONG
Academia Sinica, Peking.

THE principal collections dealt with in this paper are those made by F. Ludlow and G. Sherriff and their associates in the Eastern Himalaya and by O. Polunin in Nepal, which are deposited in the Department of Botany, British Museum (Natural History). The former are the more important, not simply because of their greater volume but chiefly from their provenance. As is shown by the map of the distribution of the genus *Pedicularis* in eastern Asia published by Hui-Lin Li in part 1 of his " Revision of the genus Pedicularis in China " (*Proc. Acad. Nat. Sci. Philad.* c : map 2 (1948)) there is a lack of distributional records between the Sikang-Yunnan region in the east and the Sikkim Himalaya further west. In this gap lie Bhutan and south-eastern Tibet, and it includes the area generally known as the Eastern Himalaya. Although visited by F. Kingdon-Ward, some of whose *Pedicularis* collections were enumerated by Marquand and Airy Shaw in *Journ. Linn. Soc. London, Bot.* xlviii : 210–214 (1929), this region had not hitherto been explored for botanical purposes. The Sikang-Yunnan and Sikkim regions boast the highest concentrations of *Pedicularis* species in the world. Hence it seemed probable that our meagre knowledge about the intervening region was not due to any natural deficiency in species there, but simply to lack of material. The gap was unlikely to constitute a natural poverty-stricken area in the distribution of the genus like the deserts of Mongolia. It was obvious that valuable and important collections were likely to come from this hitherto unexplored area in which Ludlow and Sherriff and their companions worked so thoroughly. The wealth of *Pedicularis* material obtained confirms the high expectation of what might be discovered in this region. It is sufficient to mention that the Bhutan-Tibet collections alone contain seventy-seven species; of these, twenty-five species are described below for the first time. This high percentage of endemism compares favourably with that of the adjoining areas. These new species in some instances help us better to understand species already known by indicating phyletic relations. Others exhibit morphological features not previously recorded.

Polunin's collection was made in Nepal, and *Pedicularis* material from that country was studied by Prain and enumerated in two papers (*Journ. As. Soc. Bengal,* lviii : 255–278 (1889) ; *Ann. R. Bot. Gard., Calcutta,* iii : 1–196 (1890)). Three new species from Nepal are described in this paper.

In addition to the above, five new species were found among miscellaneous collections gathered by F. Kingdon-Ward, Miss E. G. Benham, A. Petelot and A. F. G. Kerr.

I take this opportunity of acknowledging the kindness of the Keeper of Botany in putting at my disposal the rich material of the British Museum (Natural History).

To other members of the botanical staff I wish to express my indebtedness for the help freely given to me during my stay. Finally, my gratitude is due to Messrs. F. Ludlow and G. Sherriff, whom I was fortunate enough to meet in the Museum, for their information about various localities represented in their collections, without which much more work would necessarily have been involved.

In this paper the arrangement of the species follows a classification of the genus which, it is hoped, will shortly be published.

The classification of infraspecific taxa adopted here is based on the current opinion that the vegetative characters within this genus are less liable to change than floral characters. Consequently, all variations pertaining to vegetative organs are kept under the rank of *subspecies*, those pertaining to the corolla under that of *variety*, and those pertaining to the colour of flowers under that of *forma*. In such a way it is possible to arrange the various ranks at will, without overlapping each other, to suit the actual conditions prevailing.

PEDICULARIS OEDERI Vahl in Hornem., *Oekon. Plantel.* ed. 2 : 580 (1806).

This is one of the most variable species in the genus *Pedicularis*. The variations are by no means limited to the vegetative organs alone, but happen alike in the structure and colouring of the flowers. Apparently the variations occur quite at random ; the long-hooded form of flower may be found associated with both typical foliage and with foliage having a gill-like arrangement. Likewise, the red colouring may arise in forms with typical short-hooded flowers and in forms with long-hooded flowers.

Subsp. **branchiophylla** (Pennell) Tsoong, comb. nov.

P. branchiophylla Pennell, *Scroph. W. Himal :* 142, *t.* 25*a* (1943).

The gill-like arrangement of pinnae is by no means limited to the eastern Himalayan form described by Pennell from Sikkim as a new species, but is shared by specimens from China and elsewhere. These do not warrant specific rank on that account.

PEDICULARIS CRYPTANTHA Marquand & Shaw in *Journ. Linn. Soc. London, Bot.* xlviii : 211 (1929).

In the following subspecies of *P. cryptantha* the habit is erect rather than diffuse. It is found in pine forest, while the type (subsp. *cryptantha*) usually inhabits more open situations.

Subsp. **erecta** Tsoong, subsp. nov.

A typo habitu compacto erecto vix 7 cm. alto, foliis minoribus (petiolo incluso 4·5 mm. tantum longis), calyce densius piloso satis distincta.

S.E. TIBET: Deyang La, Kongbo, 3,048 m., growing in pine forest ; perianth yellow ; 25th May, 1947, *Ludlow, Sherriff & Elliot 15060* (holotype in Herb. Brit. Mus.).

Pedicularis filiculiformis Tsoong, sp. nov. (Ser. *Filiculae*).

Herba perennis. *Radiculae* plurimae subcylindricae pinguae. *Caules* singuli vel perpauci, basi squamis siccis lanceolatis dense obtecti, 12 cm. alti, glabri. *Folia* radicalia longe petiolata, petiolis ad 4 cm. longis, lamina oblonga, 15–30 mm. longa, 5–11 mm. lata, pinnatisecta, segmentis 6–13-jugis oblongis iterum lobulato-dentatis, supra glabra subtus albido-furfuracea. *Inflorescentia* manifeste centrifuga, floribus racemosis. *Calyx* 8 mm. longus, leviter fissus, dentibus ut in *P. filicula* Franch. *Corollae* tubus 15 mm. longus; galeae pars verticalis 3 mm. longa, pars antherigera 5 mm. longa, 2·5 mm. lata, sensim in rostrum 4·5 mm. longum apice denticulatum abiens ; labium inferum 10 mm. longum ac latum, lobo medio rotundato, vix minora quam lateralibus, omnibus margine ciliatis. *Filamenta* antica pilosa.

Var. **filiculiformis.**

S.E. TIBET : Taktsang, Tsari, 4,420 m., on open damp stony hillside ; .corolla wine red, white at the throat ; 22 June, 1936, *Ludlow & Sherriff 2197* (holotype in Herb. Brit. Mus.).

This species is rather close to *P. filicula* Franch., from which it differs in having a branched fleshy rhizome similar to that of *P. rupicola* Franch., and not fasciculate and spindle-shaped as in *P. filicula*. The flower differs also in its longer tube and beak, the latter pointing forward instead of definitely downwards. The segments of the leaves are also less numerous. *P. wallichii* Bunge, which is somewhat akin, has a much longer vertical portion of galea and a fewer flowered inflorescence, which gives it a very different general appearance.

Var. **dolichorrhyncha** Tsoong, var. nov.

A var. *filiculiforme* galeae rostro satis longiore recedit.

BHUTAN : Me La, 4,420 m., on overgrown boulders ; flowers purple, faintly scented ; 20th June, 1949, *Ludlow, Sherriff & Hicks 20380* (holotype in Herb. Brit. Mus.).

The habit and floral characters differ little from those of the specific type, except for the beak being much longer and more slender at the tip, in which character it approaches *P. takpoensis* Tsoong. That species can, however, easily be recognized by the absence of broad basal scales, the generally much lower habit and the less densely hairy anterior filaments.

Pedicularis takpoensis Tsoong, sp. nov. (Ser. *Filiculae*)

Herba perennis, humilis, ad 9 cm. alta. *Radix* elongata, carnosa. *Caules* saepe plurimi, basi petiolis vetustioribus filiformibus dense vestiti. *Folia* radicalia longe petiolata, petiolis ultra 3 cm. longis, glabris ; lamina lanceolato-oblonga, 7–15 mm. longa, 3–5 mm. lata, pinnatipartita, segmentis 7–8-jugis crenato-dentatis margine magis revolutis, supra glabra subtus albo-furfuracea ; caulina minora 3–5-jugatim pinnatipartita. *Inflorescentia* centrifuga, floribus circ. 7–8 racemosis. *Calyx* leviter fissus, tubo 5 mm. longo glabro, dentibus inaequalibus 2·5 mm. longis stipitatis

apice inflatis dentatis denticulis valde reflexis. *Corollae* tubus 16 mm. longus, glaber; galeae pars verticalis 5 mm. longa, pars antherigera in angulo recto inflexa, 4 mm. longa, 2·5 mm. lata, gradatim in rostrum tenue 5 mm. longum apice leviter dilatatum attenuata; labium inferum 10 mm. longum, 12 mm. latum. *Filamenta* antica leviter pilosa.

S.E. TIBET: Chiniung La, Langong, Takpo, 4,260 m., on rocky open slope; perianth wine red, tip of galea a little darker, throat white; stem crimson; 20th June, 1938, *Ludlow, Sherriff & Taylor 5614* (holotype in Herb. Brit. Mus.).

Although closely allied to *P. filiculiformis* Tsoong this species has no broad basal scales, but is furnished instead with slender persistent petioles. The beak is also much longer.

PEDICULARIS NEPALENSIS Prain in *Journ. As. Soc. Bengal* lviii, 2: 268 (1889).

Forma **alba** Tsoong, forma nov.

A typo recedit floribus albis haud coloratis.

BHUTAN: Rinchen Chu, Takse La, 4,725 m.; in scree; calyx pale green, tips darker green; corolla snow white; 18th August, 1949, *Ludlow, Sherriff & Hicks 17160* (holotype in Herb. Brit. Mus.).

PEDICULARIS PRZEWALSKII Maxim. in *Bull. Acad. Imp. Sci. St. Pétersb.* xxiv: 55 (1878).

Subsp. **australis** (Li) Tsoong, comb. nov.

P. przewalskii: var. *australis* Li in *Proc. Acad Nat. Sci. Philad.* ci: 113 (1949)

S.E. TIBET: Hills north of Lhasa, 3,960–4,260 m.; 25th June, 1943, *Ludlow & Sherriff 9707.* Hills south of Lhasa, on the Sha La, 4,260 m.; 11th July, 1943, *Ludlow & Sherriff 9763.* Reting, 60 miles north of Lhasa, 4725 m.; 24th July, 1942, *Ludlow & Sherriff 8873.*

Pedicularis bella Hook. f., *Fl. Brit. Ind.* iv: 313 (1884).

P. bella is a highly variable species.

Subsp. BELLA

P. bella var. *typica* Li in *Proc. Acad. Nat. Sci. Philad.* ci: 110 (1949).

Subsp. **holophylla** (Marq. & Shaw) Tsoong, comb. nov.

P. bella var. *holophylla* Marquand & Shaw in *Journ. Linn. Soc. London, Bot.* xlviii: 211 (1929).

Subsp. **holophylla** var. **crestifrons** Tsoong, var. nov.

A typo subspeciei *holophyllae* differt tantum galea ad finum partis antherigerae crista prominenti 1·5 mm. lata abrupte munita.

S.E. TIBET: Doshong La, Kongbo, 4,115 m.; on cliff faces; calyx green, corolla snow white, spur purple, tube very pale yellow; 18th August, 1947, *Ludlow, Sherriff & Elliot 14403* (holotype in Herb. Brit. Mus.).

An interesting plant which, in the shape of the leaves, agrees perfectly with Marquand and Shaw's var. *holophylla*, but has a prominently crested galea.

PEDICULARIS LONGIFLORA Rudolph in *Mém. Acad. Imp. Sci. St.-Pétersb.* iv : 345, t. 2 (1811).

Var. **tubiformis** (Klotzsch) Tsoong, comb. nov.

P. tubiformis Klotzsch in Klotzsch & Garcke, Bot. Ergebn. Reise Prinz Waldemar : 106, t. 57 (1862).

P. longiflora subsp. *tubiformis* (Klotzsch) Pennell, Scroph. W. Himal : 150 (1943).

PUNJAB : Chitkal, Baspa Valley, Simla Hill States, 3,810 m. ; 17th July, 1939, *Sherriff 7436.*

KASHMIR : Shushal, Ladak, 4,350 m. ; 1st August, 1931, *Ludlow 833.* Leh Ladak, 3,505 m. ; 8th July, 1941, *Ludlow & Sherriff 8475.* Khardong La, 4,572 m.; 19th August, 1928, *Ludlow 492.*

NEPAL : Brangechen Kharka, 4,570 m.; 11th June, 1949, *O. Polunin 295.*

BHUTAN : Laya, Upper Mo Chu, 3,658 m. ; 4th August, 1949, *Ludlow, Sherriff & Hicks 16449.* Kantanang, Tsampa, 3,810 m. ; 11th July, 1949, *Ludlow, Sherriff & Hicks. 19110.* Me La (south side), 3,960 m. ; 22nd August, 1949, *Ludlow, Sherriff & Hicks 21066.* Cho La, 3,650 m. ; 21st August, 1949, *Ludlow, Sherriff & Hicks 21413.*

S.E. TIBET : Yatung, Amo Chu Valley, 3,200 m. ; 10th October, 1942, *Ludlow & Sherriff 10035.*

PEDICULARIS SIPHONANTHA D. Don, *Prodr. Fl. Nepal.* : 95 (1825).

Subsp. **prostrata** (Bonati) Tsoong, comb. nov.

P. siphonantha var. *prostrata* Bonati in Rec. Bot. Survey Ind. iv : 400 (1913).

BHUTAN : Lao La, Ritang, 3,505 m. ; 2nd June, 1937, *Ludlow & Sherriff 3172.*

PEDICULARIS MEGALOCHILA Li in *Taiwania,* i : pl. 1, fig. 7, 91 (1948).

The type of this species was collected in 1931 by F. Kingdon-Ward in the Adung Valley, Burma and seems to have had yellow flowers. According to the field notes of later collectors, the colour seems to be extremely variable and ranges from pink with whitish margin (*Ludlow & Sherriff 2229*) to deep reddish purple (*Ludlow & Sherriff 1921*). *P. megalochila* is easily confused with three other similar species, i.e. the red-coloured form being mistaken for *P. rhinanthoides* Schrenk and its several varieties, and also for *P. megalantha* D. Don ; the yellow-flowered form for *P. hoffmeisteri* Klotzsch. From the first, however, it can be easily distinguished by its galea which leans back rather than bends slightly forward as in that species. From the two other species (to which it is more closely related than the first), it may be recognized by its perennial, non-branching habit and its branching roots. The absence of well developed cauline leaves and the much smaller capsules also help to separate it from these species. Another form with the same yellow flower, but slightly longer tube and narrow ligulate mid-lobe of the lower lip, looks sufficiently distinct

to be a new species, but as some specimens are intermediate between it and the typical form, it is described below as a variety.

Var. **ligulata** Tsoong, var. nov.

Tubus corollae quam in typo longior; labium inferum angustum lobo medio liguliformi.

S.E. TIBET: Singo Samba, Lo La Chu near Molo, Kongbo, 3,810 m.; open dry hillsides; flower yellow, spur dark purple; 28th June, 1936, *Ludlow & Sherriff 1874* (holotype in Herb. Brit. Mus.). Tsari Sama, Langong, Takpo, 3,960–4,115 m.; 16th June, 1938. *Ludlow, Sherriff & Taylor 5574.*

Forma **rhodantha** Tsoong, forma nov.

Flores dilute rosei usque ad atropurpurei, quoad gradum coloris variabiles sed structura cum typo speciei congruentes.

BHUTAN: Rinchen Chu, La Chu La, 4,725 m.; 17th August, 1949, *Ludlow, Sherriff & Hicks 17137.* Narim Thang, 3,960 m.; 23rd July, 1949, *Ludlow, Sherriff & Hicks 21323.* Shingbe (Me La), 4,115 m.; 23rd August, 1949, *Ludlow, Sherriff & Hicks 21088.* Me La, 4,260 m.; 6th August, 1933, *Ludlow & Sherriff 425.* Me La, Cho La Valley, 3,960 m.; 2nd July, 1949, *Ludlow, Sherriff & Hicks 20456a.*

S.E. TIBET: Truka La, Mago, 4,420 m.; 5th August, 1934, *Ludlow & Sherriff 819.* Sur La, Tsari, 4,572 m.; 28th July, 1936, *Ludlow & Sherriff 1954.* West Tsari, Takar La, 4,260 m.; 27th June, 1936, *Ludlow & Sherriff 2229.* Chikchar, Tsari, 4,260–4,572 m.; 23rd August, 1936, *Ludlow & Sherriff 2476.* Pa La, near Kyimdong Dzong, Kongbo, 4,115 m.; 18th July, 1936, *Ludlow & Sherriff 1921.* Chiniung La, Langong, Takpo, 4,572 m.; 20th June, 1938, *Ludlow, Sherriff & Taylor 5607.*

Pedicularis longipedicellata Tsoong, sp. nov. (Ser. *Asplenifoliae*)

Herba perennis, acaulis, vix ultra 10 cm. alta, basi petiolis pedicellisque vetustioribus siccis dense vestita. *Radices* elongati subfusiformes. *Folia* omnia radicalia, longe petiolata, petiolis usque ad 30 mm. longis, alatis, glabris; lamina alte pinnatifida usque pinnatisecta, ambitu lineari-lanceolata, circa 20 mm. longa, 7 mm. lata, fere glabra, segmentis ovato-oblongis usque oblongo-linearibus, plus minus distantibus. *Flores* singulares, pedicellis radicalibus glabris, 16–65 mm. longis. *Calyx* cylindricus, 13 mm. longus, tubo 7 mm. longo, fere glabro, dentibus subaequalibus basi stipitatis apice satis accrescentibus foliaceis, grosse paucidentatis, margine reflexis. *Corollae* tubus 20–24 mm. longus, externe secus venas laterales pubescens; galeae pars verticalis circa 8 mm. longa, pars antherigera 6 mm. longa, 4·5 mm. lata, apice in rostrum breve 3 mm. longum fere abrupte attenuata; labium inferum 15 mm. longum, 19 mm. latum, trilobatum, lobo medio rotundato integro lateralibus ellipticis paulo minore, omnibus margine ciliatis. *Filamenta* antica leviter pilosa, fere glabra.

BHUTAN: Kantanang, Tsampa, 4,260 m.; in moss on rocks and beside dwarf Rhododendron; perianth wine red, pale in throat and helmet darker; 10th June, 1949, *Ludlow, Sherriff & Hicks 19093*; (holotype in Herb. Brit. Mus.). Saga La,

Upper Mangde Chu, 4,725 m.; 14th July, 1949, *Ludlow, Sherriff & Hicks 16835.* Marlung, Tsampa, 4,725 m.; 11th July, 1949, *Ludlow, Sherriff & Hicks 19406a.*

This species comes very near *P. wallichii* Bunge in the general structure of the flowers. They agree in having an elongate vertical part of the galea, a thick anther-bearing part, and a short stout beak. The new species can, however, be easily distinguished by the more or less spindle-shaped rootlets and the lack of a stem which is supplanted in function partly by the elongated pedicels that reach sometimes a length of 6·5 cm. It also shows affinity to the European *P. portenschlagii* Sauter and *P. asplenifolia* Floerke, but both these species are definitely caulescent and differ in floral structure.

Pedicularis rhizomatosa Tsoong, sp. nov. (Ser. *Asplenifoliae*)

Herba perennis, humilis, vix 7 cm. alta. *Rhizoma* elongatum, tenue, ad nodos squamis siccis ovatis vel lanceolatis ornatum; caules singuli vel pauci, basi squamis ovatis dense obtecti. *Folia* longe petiolata, omnia radicalia, petiolis quam lamina 2–3-plo longioribus, ad 3 cm. longis, membranaceo-alatis; lamina oblonga, 6–11 mm. longa, 3–5 mm. lata, profunde pinnatipartita fere pinnatisecta, rhachide alata, segmentis 3–4 jugis ovato-oblongis, herbaceis, lobulato-dentatis margine magis reflexis glabris. *Scapus* nudus, 5 cm. altus, superne longe pilosus; *inflorescentia* subumbellata floribus congestis terminatus, bracteis tripartitis iis, *P. albiflorae* Prain et *P. meyanae* Hand.-Mazz. similibus, longe et sparse ciliatis. *Calyx* 5-dentatus, parvus, tubo 4 mm. longo, dentibus valde inaequalibus 2–3 mm. longis, omnibus stipitatis, apice plus minus dilatatis et subtrilobatis. *Corollae* tubus 10 mm. longus, glaber; galeae pars verticalis 3 mm. longa, pars antherigera 4 mm. longum, 2 mm. latum, fere abrupte in rostrum longum tenue 5 mm. longum porrectum producta; labium inferum leviter ciliatum, ambitu deltoideum, basi truncatum, apicaem versus attenuatum, lobo medio parvo vix dimidium loborum lateralium ad medium leviter retusorum aequante. *Filamenta* antica sparse pilosa.

S.E. TIBET: Tamnyen La, Kongbo, 3,652 m.; on avalanche slope; corolla deep magenta, galea bent at right angles, purplish black; 22nd June, 1938, *Ludlow, Sherriff & Taylor 4944* (holotype in Herb. Brit. Mus.).

A species allied to *P. meyana* Hand.-Mazz., *P. umbelliformis* Li and *P. tsarungensis* Li, but differing from these in the absence of the densely matted persistent petioles of the previous year's growth. The chief difference lies, however, in the long rhizome which is single and horizontal, and, like the base of the stem, is furnished with lanceolate scarious scales.

Pedicularis perpusilla Tsoong, sp. nov.

Herba nana, vix 5 cm. alta. *Radiculae* paucae, plerumque binis, fusiformes, 5–10 mm. longae, apice attenuatae et fibrosae. *Caules* valde abbreviati, ad 15 mm. longi, bifariam pubescentes, basi squamigeri. *Folia* radicalia longe petiolata, petiolis 6–13 mm. longis, inferne plus minus dilatatis, membranaceis; lamina ad 12 mm. longa, vix 5 mm. lata, pinnatisecta, segmentis distantibus, circ. 7-jugis, ovato-oblongis margine vulgo valde revolutis ambitu igitur quasi oblongo-linearibus.

Flores pauci (1–3), pedicellis ad 5 mm. longis, glanduloso-pubescentibus. *Calycis* tubus 6 mm. longus, antice ad 2/3 fissus, fere glaber, dentibus 3, postico magis reducto, lateralibus postico duplo saltem majoribus apice leviter dilatatis lanceolatis. *Corollae* tubus 18 mm. longus, externe subdense pilosus ; galeae pars verticalis 3 mm. longa, pars antherigera 6 mm. longa, apice in rostrum breve circa 4 mm. longum sensim attenuata ; labium inferium amplum, margine ciliatum, trilobatum, lobo medio transverse elliptico, apice retuso, 4 mm. longo, 5·5 mm. lato, iis lateralibus medio plus quam duplo majoribus, ellipticis, 10 mm. longis, 6 mm. latis. *Filamenta* antica apice dense pubescentia.

BHUTAN : Pung La, 3,652 m. ; peaty soil on rocks ; flowers crimson marked with white ; 9th July, 1949, *Ludlow, Sherriff & Hicks 20906* (holotype in Herb. Brit. Mus.).

This species seems to be most closely related to *P. taylorii* Tsoong, but differs in having spindle-shaped instead of fibrous rootlets, a much shorter tube, but stronger galea. This, together with *P. taylorii, P. hicksii* Tsoong, *P. pseudoregeliana* Tsoong and *P. tapaoensis* Tsoong, a species described from Kanting (Tatsienlu) in Dr. H. Smith's collection (*Smith no. 11460*), forms a new series characterized by often dwarf habit and few, usually pedicellate flowers with a tube attaining a great length. The species of this series bear a close relationship to those of series *Asplenifoliae*, which consists of *P. asplenifolia* Floerke, *P. meyana* Hand.-Mazz., *P. umbelliformis* Li, etc., but differ from them in the much longer tube which is almost on para with those of series *Longiflorae*.

Pedicularis hicksii Tsoong, sp. nov.

Herba perennis, nana, vix 6 cm. alta. *Radices* multae caespitosae fibriferae ad 6 cm. longae. *Caules* brevissimi vel subnulli. *Folia* omnia radicalia, petiolis ad 17 mm. longis, glabris; lamina lanceolata usque oblonga, 10–15 mm. longa, 3–5·5 mm. lata, ad medium pinnatifida, segmentis 4–5-jugis, triangulari-ovatis, iterum serratis, utrinque laxissime pubescentia. *Flores* ad 15 mm. longe pedicellati. *Calyx* membranaceus, 5-costatus, antice leviter fissus, tubo 7 mm. longo, dentibus 5, postico paulo monore, omnibus stipitatis apice flabelliformibus, inciso-dentatis. *Corollae* tubus circa 16 mm. longus, galeae pars verticalis 4 mm. longa, pars antherigera inflexa, 6 mm. longa, 3·5 mm. lata, in rostrum 3 mm. longum apice erosum attenuata ; labium inferum 9 mm. longum, 13 mm. latum, ad medium in lobos tres subaequales fissum, lobo medio rotundato apice retuso ; *Filamenta* antica breviter pubescentia.

BHUTAN : Shingbe (Me La), 4,420 m. ; scree ; flower crimson ; 24th August, 1949, *Ludlow, Sherriff & Hicks 21099* (holotype in Herb. Brit. Mus.).

A species distinct within the series by its long fibrous roots and relatively shallowly lobed leaves.

Pedicularis taylorii Tsoong, sp. nov.

Herba annua (?), caespitosa. *Radiculae* fibrosae multae caespitosae. *Caules* perpauci, glabri, nigrescentes, floribus inclusis vix 7 cm. alti. *Folia* omnia radicalia, petiolis 10–15 mm. longis ; lamina profunde pinnatisecta, 5–10 mm. longa, 2·5–

4·5 mm. lata, segmentis 5–6 jugis ovatis 1·5 mm. longis × 1 mm. latis, acute serratis sed dentibus saepe recurvis deinde quasi obtusis. *Flores* perpauci, plerumque 2, distincte pedicellati; pedicellis 4–10 mm. longis, bifariam pubescentibus. *Calyx* cylindricus, 7 mm. longus, tubo inferne glanduloso-pubescenti, superne fere glabrescentia, ultra medium fisso, dentibus variis vario modo connectis, 3 vel incomplete 5, posteriore lineari ceteris multo minore, apice vix dilatato, reliquiis apice laminam ovatam lobulatam gerentibus. *Corollae* tubus 22 mm. longus, externe pubescens; galeae pars verticalis vix 4 mm. longa, abrupte in partem antherigeram horizontalem 3·5 × 2·4 mm. decurva, apice in rostrum 5–5·5 mm. longum bilobatum continuata; labium inferum 9 mm. longum, 14 mm. latum, lobo medio parvo dimidium loborum lateralium vix aequante. *Filamenta* anteriora quam posteriora densius pilosa.

S.E. TIBET: Tsari Sama, Langong, Takpo, 4,115 m.; on open wet grassy hillside; galea upright and curled back; perianth wine-red, with a small white patch at throat; 16th June, 1938, *Ludlow, Sherriff & Taylor 5578* (holotype in Herb. Brit. Mus.).

Pedicularis pseudoregeliana Tsoong, sp. nov.

Herba perennis, humilis, fere acaulis, collo squamis scariosis nonnullis late ovatis usque lineari-lanceolatis ornato. *Radices* paucae, 2–4, vix incrassatae, fibrosae. *Folia* fere omnia radicalia, longe petiolata, petiolis 10–25 mm. longis breviter et parce pubescentibus; lamina oblonga usque oblongo-linearia, 8–15 mm. longa, 4 mm. lata, pinnatisecta, segmentis 4–9 jugis distantibus argute inciso-serratis ovatis. *Pedicelli* glabri, 5–7 mm. longi, in fructu valde elongati 30 mm. longi. *Calyx* glaber, ad medium fissus, dentibus 2, latioribus quam longioribus, valde inciso-lobatis. *Corollae* tubus elongatus 32 mm. longus, 1·4 mm. latus, externe parce pilosus; labium amplum 11 mm. longum, 15 mm. latum, trilobatum, lobo medio obovato truncato reliquiis paulo minore; galeae pars verticalis 5 mm. longa, e basi tenui ad apicem gradatim ampliata, margine antice dentigera, pars antherigera ampla, 5 mm. longa, 3·5 mm. lata, apice in rostrum ad extremum bifidum 5 mm. longum angustata. *Filamenta* in tertia parte superiore tubi inserta, anterioribus densius posterioribus laxius pilosis. *Capsulae* vetustiores triangulari-lanceolatae acutae 12 mm. longae, 5 mm latae.

NEPAL: Dhudkund, 6 miles east of Timure, 4,725 m.; damp banks near stream; flowers pink-purple; 5th July, 1949, *O. Polunin 831* (holotype in Herb. Brit. Mus.).

In general appearance this new species recalls *P. regeliana* Prain, but structurally it is very different. Its true relationship is with *P. tapaoensis*. It agrees with that species in the general shape of the lower lip of the flower, as also of the galea, especially the dentate anterior margin, but differs in the much finer and longer tube and the two-toothed deeply split calyx. The leaves are also narrower and longer.

Here also belongs *Lal Dhwoj 106*, likewise from Nepal, now preserved in the Edinburgh Herbarium.

Pedicularis tantalorrhynchoides Tsoong, sp. nov.

Herba perennis. *Rhizoma* verticale elongatissimum carnosum usque 30 cm. longum. *Caules* caespitosi, ad 17 cm. alti, ei anni praecedentis saepe persistentes, basi squamigeri. *Folia* radicalia longissime petiolata, petiolis ad 7 cm. longis, glabris, saltem basin versus membranaceo-alatis, leviter dilatatis ; lamina 3–3·5 cm. longa, 11–18 mm. lata, oblonga, alte pinnatifida vel pinnatisecta, segmentis circa 8-jugis oblongis usque deltoideo-ovatis, margine dentatis valde recurvis, utrinque laxe pilosis, caulina opposita 1–2 paria brevius petiolata. *Inflorescentia* centripeta, verticillastris distantibus, bracteis foliaceis. *Calyx* antice vix fissus, tubo 6 mm. longo, 5-costato, sparsissime albo-piloso, dentibus 5, postico subulato 1·5 mm. longo, reliquiis stipitatis apice valde dilatatis foliaceis inciso-dentatis vel lobulatis. *Corollae* tubus circa 10 mm. longus glaber ; galeae pars verticalis 3 mm. longa, pars antherigera circa 5 mm. longa, apice in rostrum 5 mm. longum sensim attenuata ; labium inferum 10 mm. longum, 13 mm. latum, margine ciliatum, ad 2/5 trilobatum, lobo medio late ovato, usque transverse elliptico, 4 mm. longo, 5–5·5 mm. lato, haud stipitato. *Filamenta* antica mediocriter pilosa. *Capsulae* ovato-oblongae subaequalilaterales apiculatae, 10 mm. longae, 4·5 mm. latae.

S.E. TIBET : Ba La, Pasum Chu, Kongbo, 4,725 m. ; grass adjoining avalanche slopes ; corolla reddish pink, 27th June, 1947 *Ludlow, Sherriff & Elliot 14025* (holotype in Herb. Brit. Mus.). Tsanang La, near Paka, Kongbo, 4,260 m. ; 18th July, 1938, *Ludlow, Sherriff & Taylor 5874*. Lusha Chu, Kongbo, 3,960 m. ; 12th June, 1938, *Ludlow, Sherriff & Taylor 4790*.

A species closely allied to *P. tantalorrhyncha* Franch., this can easily be distinguished by its leaves having longer petioles and less numerous pinnae, by its calyx being scarcely split, by its galea being not crested and lastly by its lip being less deeply divided with the mid-lobe broader than long, not longer than broad and somewhat stipitate as in *P. tantalorrhyncha*. The pedicels in *P. tantalorrhynchoides* are spreading, so that the inflorescence is over 3 cm. across, while in *P. tantalorrhyncha* they are erect or strongly ascending, so that the inflorescence is only 18 mm. across.

Here also belongs *Kingdon-Ward 5904*, from Temo La, formerly identified as *P. cephalantha* Franch.

Pedicularis sherriffii Tsoong, sp. nov.

Herba humilis, ad 9 cm. alta. *Rhizoma* breve crassum, radiculis plurimis caespitosis cylindricis elongatis longioribus ad 18 cm. longis munitum, apice petiolis vetustioribus persistentibus saepe ornatum. *Caules* arcuato-adscendentes vel patentes, inferne laxius superne densius pilosi. *Folia* radicalia longe petiolata, petiolis ad 4 cm. longis glabris, basin versus laxe pilosis ; lamina oblongo-elliptica usque elliptica, 3 cm. longa, 16 mm. lata, pinnatisecta, segmentis 4–5-jugis ovato-ellipticis basi cuneatis margine inciso-lobulatis lobulis iterum paucidentatis. *Folia* caulina brevius petiolata, opposita ; lamina illi foliorum radicalium simillima sed segmentis paucioribus. *Flores* in axillis foliorum superiorum in fasciculis disjunctis. *Calyx* 9–11 mm. longus, laxe sed longe pilosus, tubo vix longiore quam dentibus (quorum postico paulo minore est) omnibus stipitatis apice nonnunquam valde inflatis foliaceo-multilobatis. *Corollae* tubus 16 mm. longus, 3 mm. latus, externe levissime pubescens, sursum infra labium dilatatus, incurvus ; galea latitudine tubi, 9 mm. longa, fere erecta, apice dentibus duobus brevibus sed satis distinctis ornata ; labium galea paulo longius, 11 mm.

longum et fere 11 mm. latum, lobis omnibus oblongis, medio lateralibus paulo minore. *Filamenta* antica leviter pilosa postica glabra.

S.E. TIBET : Chubumbu La (South side), Langong, Takpo, 3,960–4,260 m. ; on open earthy slopes, south face ; growing in large clumps ; galea slightly arcuate, deep wine-red at tip, remainder of perianth wine-red, almost white in the centre : 7th June, 1938, *Ludlow, Sherriff & Taylor 3991* (holotype in Herb. Mus. Brit.).

Among species already known this comes nearest *P. collata* Prain. It has, however, a very different appearance because of its strongly diffuse habit. The stems are densely pubescent and procumbent and somewhat woody. The corolla differs also in the apically prominently curved tube which in *P. collata* is straight and shorter. Its true ally is, in fact, another species *P. atroviridis*, described immediately below, with which it form a very natural new series.

Pedicularis atroviridis Tsoong, sp. nov.

Herba humilis, vix 7 cm. alta. *Radiculae* elongatae caespitosae lineares vel paulo incrassatae longioribus ad 8 cm. longis, collo squamis scariosis ovatis obtecto. *Caules* caespitosi arcuato-adscendentes pilosi. *Folia* radicalia longe petiolata, petiolis ad 23 mm. longis glabris ; lamina ovata vel ovato-elliptica 12 mm. longa, 8 mm. lata, pinnatisecta segmentis ovatis circ. 4-jugatim pinnatipartitis lobis argute paucidentatis. *Folia* supera et floralia subopposita vel opposita, ovata vel rotundata, brevius petiolata, petiolis ad 6 mm. longis ; lamina ovata tri-vel subquinque-lobata. *Flores* pauci in fasciculis singulis terminalibus vel raro binis paulo distantibus. *Calyx* glaber, tubo 4·5 mm. longo, dentibus 5, postico triangulari cuspidato reliquiis linearibus apice vix incrassatis leviter recurvis 1·5 mm. longis dimidio breviore. *Corollae* tubus circa 12 mm. longus, externe pilosus, inferne strictus, superne infra labium leviter incurvus ; galea 6·5 mm. longa, dorso leviter incumbente, fronte abrupte decurba margine infero bidentata ; labium inferum galeam multo excedens, circa 1 cm. longum et latum, margine leviter erosum glabrum, lobis omnibus pilosis. *Filamenta* prope basim tubi inserta, anticis tantum pilosis. *Stylus* leviter vel vix exsertus.

S.E. TIBET : Tum La, Nayü, Kongbo, 3,652 m. ; on open moss covered slopes ; perianth bright purplish-pink ; galea upright, slightly arcuate, pale at throat ; leaves very dark green ; 9th July, 1938, *Ludlow, Sherriff & Taylor 5801* (holotype in Herb. Brit. Mus.).

Closely allied to *P. sherriffii* above, *P. atroviridis* differs in the radical leaves being much bigger and longer petiolate, the calyx-teeth more foliaceous, the corolla-tube less hairy and the galea more rounded at the apex.

Pedicularis elliotii Tsoong, sp. nov.

Herba vix 15 cm. alta. *Radices* caespitosi cylindrico-fusiformes plus minusve carnosi. *Caules* e collo profuse emittentes ramosissimi prostrati vel adscendentes glabri. *Folia* radicalia evanida, petiolis linearibus subhyalinis, caulina opposita, inferiora longe petiolata, petiolis 4·5 mm. longis ; lamina 35 mm. longa, 20 mm. lata, ambitu elliptico-ovata, infra medium bipinnatisecta, antice simpliciter et irregulariter pinnatisecta, pinnis petiolulatis (petiolulis ad 2·5 mm. longis), iterum pinnatisectis, 10 mm. longis, 6 mm. latis, segmentis 2–3-jugis stipitatis 2·5 mm. longis, apice dilatatis inciso-dentatis vel pinnatifidis ; folia caulina superiora minora, petiolis paulo quam lamina brevioribus, lamina elliptico-oblonga, pinnatisecta. *Flores* omnes axillares, distincte pedicellati, pedicellis ad 8 mm. longis, leviter villosis. *Calyx* 1 cm. longus, sparse sed longe villosus, antice haud fissus, dentibus 5, summo multo minore lineari integerrimo, ceteris longe stipitatis apice dilatatis ovatis incisis. *Corollae* tubus tenuis glaber 25 mm. longus ; galeae pars verticalis 1–1·5 mm. longa, pars antherigera leviter inflata sub angulo recto incurva, 5 mm. longa, 2·5 mm. lata, apice in rostrum 3·5 mm. longum truncatum paene subite producta. *Filamenta* paulo infra summum tubi inserta, anticis levissime pilosis fere glabris.

S.E. TIBET : Budi Sobe La, Kongbo, 3,652 m. ; by side of a river in a damp place ; light purple flower with long whitish purple tube ; 16th June, 1947, *Ludlow, Sherriff & Elliot 15242* (holotype in Herb. Mus. Brit.).

The nearest affinity of this new species as far as can be judged is with *P. sikkimensis* Bonati. The dense matted growth of this species and the bigger flowers having a much thicker galea ending in an entire beak easily distinguish it from that species. The two form a new series which comes close to another new series typified by *P. atroviridis* Tsoong.

Pedicularis ludlowii Tsoong, sp. nov.

Herba perennis. *Radiculae* caespitosae plurimae fusiformi-cylindricae carnosae. *Caules* 1–4, arcuato-adscendentes vel erecti, 20 cm. alti, longe denseque pilis brunneis patentibus obtecti, striati. *Folia* radicalia ad 35 mm. longe petiolata, petiolis eodemmodo pilosis ; lamina ad 7 cm. longa, 25 mm. lata, bipinnatipartita-sectave, rhachide lobulato-alato, segmentis 15–20 paribus, ambitu lanceolato-oblongis, acutis, basi cuneatis vel subdecurrentibus, circa 3–5-jugatim pinnatisectis, ad 12 mm. longis, 7 mm. latis, apicem foliorum versus decrescentibus fere linearibus, utrinque (sed supra densius) setuloso-pilosa ; folia caulina opposita, vulgo 2 paria, pari inferiori longius petiolata, petiolis ad 25 mm. longis leviter dilatatis, pari superiori 7–10 mm. longe petiolata, petiolis magis dilatatis, omnibus margine ciliatis ; lamina eodemmodo lobata sed multo minora. *Flores* in spicas basi subdisjunctas apice densas ad 8 cm. longas dispositi, bracteis foliaceis basi dilatatis. *Calyx* breve pedicellatus, antice ad 1/4 vel 1/3 fissus, externe longe pilosus, tubo circa 9 mm. longo, dentibus 5, postico valde reducto, vix 1·5 mm. longo subulato, reliquiis bene evolutis foliaceis elliptico-oblongis inciso-lobulatis lobulis iterum dentatis, margine omnibus longe ciliatis. *Corollae* tubus vix calycem excedens, circa 11 mm. longus, externe glaber interne ad faucem leviter pilosulus, apice leviter ampliatus ; galeae pars verticalis 5 mm. longa, 2·5 mm. lata, pars antherigera sub angulo recto incurva, circa 5 mm. longa × 3 mm. lata sensim in rostrum rectum validum 6 mm. longum apice leviter bifidum attenuata ; labium inferum amplissimum circa 18 mm. longum, 20 mm. latum, trilobatum, margine repandum vel erosum, lobo medio lateralibus dimidio aequante, latiore quam longiore, apice emarginato. *Filamenta* super partem inferiorem tubi affixa, anticis ad insertionem et parte superiore pilosis, posticis glabris.

BHUTAN : Dungshinggang (Black Mountain), 4,572 m. ; on open grassy meadows among dwarf rhododendrons ; perianth rich wine-red, spur darker ; leaves dull green tipped purplish ; 27th June, 1937, *Ludlow & Sherriff 3323* (holotype in Herb. Brit. Mus.). Kangla Karchu La, Mo Chu drainage, 4,572 m. ; 20th June, 1949, *Ludlow, Sherriff & Hicks 16591*.

This species has no evident close relative. Its big flower, with long galea and ample lower lip, suggest some relationship to the species of series *Macranthae*, but the bipinnatisect, profusely produced radical leaves recall, on the other hand, the habit of series *Comosae* and *Rostratae*. Some resemblance is also shown to the species of series *Oliganthae*, *Infirmae*, etc., but all these are alternate-leaved. No apparent affinity is found in the opposite-leaved realm. It should be made to represent a new series to be placed tentatively near yet another new series typified by *P. sikkimensis*.

Pedicularis reptans Tsoong, sp. nov.

Herba annua (?), habitu *Potentilla reptantam* aemulans. *Radix* singularis, leviter incrassata, ad 3 cm. longa, fibrosa. *Caules* multi, tenues, vix 1/3 mm. diam., elongati, ultra 20 cm. longi vel saepe breviores, dense hirtelli, nodis ad 2·5 cm. distantibus, inferioribus vulgo radiculas fibrosas emittentibus. Folia omnia caulina, opposita, distincte petiolata, petiolis 1·5 usque 10 mm. longis, eodem modo ac caule hirtellis ; lamina rotunda, elliptica usque elliptico-oblonga, basi truncata vel leviter cordata, apice obtusissima, ad 8 mm. longa fere ac lata, utrinque ad 1/2–2/3 pinnatifida, lobis 3 vel 4-jugis, irregulariter duplicato-serratis, utrinque subtiliter reticulata. *Flores* in axillis partis mediae caulium siti, singuli ad 5 mm. longe pedicellati. *Calyx* cylindricus, densissime pilosus, ad 5·5 mm. longus, 2 mm. latus, antice vix fissus, dentibus 5, omnibus stipitatis, postico vulgo minore apiceque minus dilatato et serrato, reliquiis majoribus late ovatis profunde inciso-pauci-serratis dentibus acutissimis. *Corollae* tubus elongatus, 16 mm. longus ; galeae pars antherigera horizontalis 5 mm. longa, 2 mm. lata, antice in rostrum breve porrectum apice truncatum leviter bifidum abiens; labium inferum 6·5 mm. longum, 7·5 mm. latum, trilobum lobo medio lateralibus dimidio minore, margine omnino glabris. *Filamenta* in triente superiore tubi affixa, omnia glabra. *Stylus* leviter exsertus.

S.E. TIBET : Trulung, Po Tsangpo, Pome, 2,134 m. ; in damp ground ; flowers pink with a white spur, 20th May, 1947, *Ludlow, Sherriff & Elliot 13053* (holotype in Herb. Brit. Mus.).

P. reptans is the first species known in the genus to be completely diffuse and to root freely at the lower nodes. In general appearance it is most similar to *P. cymbalaria* Bonati, a species of the series *Lyratae*, both in habit and the shape of the leaves, but its real affinity is hard to name ; it may be far apart from that species. Its peculiar habit makes it necessary to create a new series for its accommodation. It is tentatively kept near series *Lyratae*.

Pedicularis poluninii Tsoong, sp. nov. (Ser. *Debiles*)

Herba annua. *Radix* cylindrica, fibrosa. *Caulis* simplex, erectus, ad 25 cm. altus, undique pilosus. *Folia* radicalia pauca, elliptica usque oblonga, circa 1 cm. longa, 5 mm. lata, pinnatisecta, segmentis circa 3-jugis, ovatis, vix 1·5 mm. longis, distantibus, margine argute serratis revolutis dentibus albo-cartilagineis utrinque pubescentibus, petiolis fere lamina aequilongis; folia caulina 4-verticillata, paulo minora breviusque petiolata. *Inflorescentia* e verticillastris 4–7 longe distantibus composita. *Calyx* cylindricus, pilosus, 10-costatus, 5 mm. longus, dentibus ovato-oblongis inaequalibus margine dentatis reflexis. *Corollae* tubus calyce minus quam duplo longior, glaber; galeae pars erecta 3·5 mm. longa, pars antherigera vix 2·5 mm. longa, apice in rostrum circa 3 mm. longum porrecte attenuata; labium inferum 7 mm. longum, 9 mm. latum, trilobum, lobo medio transverse elliptico, lateralibus paulo minore. *Filamenta* omnia glabra.

NEPAL: Chilime Kharka, 4,420 m.; flowers magenta; July, 1949, *O. Polunin 1149* (holotype in Herb. Brit. Mus.).

This species resembles *P. instar* Prain in habit, especially in the long interrupted inflorescence, but differs in the shape of the leaves, in the slightly shorter beak and in the lower lip, the mid-lobe of which is long stipitate and not so deeply divided from the lateral lobes. The shape of the leaves suggests rather those of *P. confertiflora* Prain and its allies.

Pedicularis canescens Tsoong, sp. nov. (Ser. *Debiles*)

Herba nana, albo-canescens. *Caulis* singulus (?), 6–10 cm. altus, erecto-adscendens, parte vetustiore glabrescens. *Folia* supra laxius subtus dense albo-lanulosa, radicalia evanida, caulina opposita, 2–3 paria, inferiora ad 7 mm. longe petiolata; lamina oblonga, circa 4-natim pinnatipartita, 6 mm. longa, 3·5 mm. lata, segmentis ovatis margine argute albo-cartilagineo-dentatis membranaceis. *Flores* aut conferti subcapitati aut in verticillastris duobus disjuncti, bracteis ambitu plerumque rhombeo-ovatis utrinque angustatis, irregulariter palmatilobatis, sessilibus, lobis magis inaequalibus herbaceis atroviridibus margine albo-cartilagineo-serratis, lamina parva, membrancacea. *Calyx* 7 mm. longus, 10-costatus, membranaceus, 5-dentatus, dentibus inaequalibus quorum 1 multo minore reliquiis 1·5–2 mm. longis ovatis margine reflexis cartilagineo-serratis. *Corollae* tubus 7 mm. longus glaber; galeae pars verticalis 3 mm. longa, pars antherigera 3·5 mm. longa, 1·5 mm. lata, apice subabrupte in rostrum leviter nutans 6 mm. longum producta; labium inferum 7 mm. longum, 8 mm. latum, aequaliter 3-lobatum, lobis omnibus late obovato-ellipticis, lateralibus ex nervo medio excurrente leviter acutis. *Filamenta* omnia glabra.

KASHMIR: Naini Tal to Srinagar, Thato Pass, 4,260–4,572 m.; *Miss G. E. Benham* (holotype in Herb. Brit. Mus.).

A species somewhat related to *P. confertiflora* Prain and its allies, but easily distinguished by its harshly canescent pilosity and the strongly cartilaginous toothing of its leaves, bracts and calyx. The bracts, which are irregularly palmatilobate with a membranaceous blade surrounded anteriorly by rather fleshy dark-green lobes, are quite unique in appearance. The apiculate lateral lobes of the lower lip provide another peculiar feature.

Pedicularis sphaerantha Tsoong, sp. nov. (Ser. *Debiles?*)

Herba humilis vel subelata, dense villosa. *Rhizoma* breve, radicibus fibrosis. *Caules* singuli vel plurimi, centrales erecti, laterales saepe arcuato-adscendentes.

Folia radicalia et caulina inferiora longius petiolata, petiolis ad 1 cm. longis, laxe pilosis ; lamina elliptica usque oblonga, 1–2 cm. longa, 5–8 mm. lata, pinnatisecta, segmentis 5–7 jugis oblongis iterum pinnatipartitis dentatisve. *Folia* caulina 3–4-natim verticillata, verticillastris 2–3 distantibus, petiolis brevibus, plus minus dilatatis ; lamina ut in folia radicalia. *Inflorescentia* condensata, globosa, bracteis basi valde dilatatis hyalinis antice palmatim multilobatis lobis cristatis. *Calyx* pilosus, 5-dentatus, dente postico triangulari-integro, reliquiis stipitatis apice 3-dentato-cristatis. *Corollae* galea erecta, parte verticali 3 mm. longa, margine antice auriculis duobus triangularibus acutis vel haud raro rotundiusculis utrinque aucta, parte antherigera horizontali, parvula, vix 4 mm. longa, 2 mm. lata, apice sensim in rostrum elongatum tenue subnutans 8 mm. longum attenuata ; labium inferum trilobatum, ambitu triangulari-ovato, margine ciliato, lobo medio parvulo plus duplo minore apice valde saccato cucullato. *Filamenta* prope medium tubi inserta, anticis sparse pilosis.

S.E. TIBET : Tumbatse, Rong Chu, Kongbo, 3,536 m. ; in boggy grassland ; corolla deep magenta pink ; galea of darker shade, falcate and slightly twisted ; 2nd July, 1938, *Ludlow, Sherriff & Taylor 5091* (holotype in Herb. Brit. Mus.). Nyima La, Kongbo, 3,810 m. ; 4th July, 1938, *Ludlow, Sherriff & Taylor 5113.*

This species is manifestly allied to *P. confertiflora* Prain, but can be recognized at a glance by the auriculate anterior margin of its galea which is somewhat crested at the base of the beak. It further differs in the ciliate margin of the lower lip, the more strongly cucullate tip of the mid-lobe which forms a small but very distinct sac, and the hairy anterior filaments. The shape of the galea looks strangely similar to that of *P. oxycarpa* Franch., a species otherwise not related.

Pedicularis inconspicua Tsoong, sp. nov. (Ser. *Debiles*)

Herba perennis, caespitosa, siccitate nigrescens, bifariam pubescens. *Radices* caespitosae, filiformes, ad 7 cm. longae. *Caules* adscendentes, circa 15 cm. alti. *Folia* radicalia longe petiolata, petiolis filiformibus, patente pubescentibus, 1·5–5 cm. longis ; lamina elliptica usque oblonga, pinnatisecta, ad 3·5 cm. longa, 13 mm. lata, supra glabra, subtus dense albo-pilosa, segmentis circa 5–8-jugis, oblongis, pinnatifidis, lobulis dentatis, margine revolutis. *Folia* caulina breviter petiolata, opposita, lamina minora. *Flores* oppositi, inferiores plus minus interrupti. *Calyx* parvus, tubo vix 3·5 mm. longo, 10-costato, dentibus 5, summo reliquiis linearibus apice leviter dilatatis tubo aequilongis dimidio minore, subulato. *Corollae* tubus paulo calycem superans, glaber ; labium inferum amplum, fere rotundatum, 12 mm. longum, 13 mm. latum, ad 1/3 trilobatum, lobis lateralibus medio rotundato 4 mm. longo ac lato plus duplo majoribus ; galeae pars verticalis 4 mm. longa, pars antherigera incurva 3–4·5 mm. longa, in rostrum 5–6 mm. longum tenuiter attenuata. *Filamenta* antica leviter pubescentia.

BHUTAN : Kantanang, Tsampa, 3,960 m. ; beside stream on steep slope ; perianth deep wine-red ; 5th June, 1949, *Ludlow, Sherriff & Hicks 19060* (holotype in Herb. Brit. Mus.).

A rather inconspicuous species, this seems to be most closely related to *P. tenuicaulis*

Prain and its ally *P. chumbica* Prain. Both these species were formerly kept in the series *Flexuosae*. In my study of the genus I found *P. flexuosa* Hook. f. to be a species most likely to have evolved directly from *P. fragilis* Hook. f., being almost identical in general habit and the shape of leaves with the latter, while the two species mentioned first are more akin to the species of series *Debiles*. These species are therefore removed with good reason from series *Flexuosae* to series *Debiles*, to be kept near *P. confertiflora* Prain. The present species in turn would justifiably be placed with *P. tenuicaulis* Hook. f., from which it differs in the nigrescent habit, the white pilosity on the under-surface of the leaves, etc.

Pedicularis xylopoda Tsoong, sp. nov.

Herba nana, 4–7 cm. alta. *Radix* cylindrica, fibroso-ramosa. *Caulis* satis lignosus, ad basim valde ramosus, bifariam pubescens, ramis lateralibus saepe procumbentibus, centrali adscendenti. *Folia* opposita, radicalia mox evanida, ut caulina inferiora longe petiolata, petiolis ad 13 mm. longis ; lamina ad 18 mm. longa, 7 mm. lata, oblongo-lanceolata, pinnatifida vel pinnatisecta, segmentis circa 5–7, late ovatis, grosse inciso-dentatis vel lobulatis, lobulis iterum vulgo tridentatis, supra laxe subtus densius pubescentia furfuraceaque. *Bracteae* filiformes, basi valde dilatatae, ambitu ellipticae. *Flores* pedicellati, pedicellis ad 5 mm. longis. *Calycis* tubus 4·5 mm. longus, antice haud fissus, albo-pilosus, dentibus 5, quorum postico subulato quam reliquiis basi stipitatis apice dilatatis latioribus quam longioribus trilobatis lobis iterum dentatis dimidio minore. *Corollae* tubus 22 mm. longus, externe pilosus ; galeae pars verticalis 4 mm. longa, margine antice ad medium breviter bidentata, pars antherigera 5–6 mm. longa, apice sensim in rostrum 4–5 mm. longum attenuata ; labium inferum basi valde cordatum, 10 mm. longum, circa 12 mm. latum, ad medium trilobatum, lobo medio quam lateralibus minore apice cucullata. *Filamenta* omnia glabra. *Capsulae* ellipticae paulo assymetricae, 12 mm. longae, 5 mm. latae, apiculatae.

BHUTAN : Pangotang, Tsampa, 4,260–4,572 m. ; on open grassy slope in little patches ; perianth and tube deep velvety wine-red or deep crimson ; 13th September, 1949, *Ludlow, Sherriff & Hicks 19741* (holotype in Herb. Brit. Mus.).

This is a species nearly related to *P. urceolata*, a new species collected near Tatsienlu by Harry Smith (*no. 10699*), but it differs from that species in its smaller dimensions, more woody stem, much denser indumentum—which is furfuraceous—more slender but shorter corolla-tube and the much darker colour of its flowers.

P. urceolata and the present new species have a close bearing on the series containing the monotypic *P. binaria* Maxim. They are most probably direct descendants of that species, which has hitherto been placed in series *Pseudorostratae* and associated with *P. tatsienensis* Bur. & Franch. and *P. chenocephala* Diels ; these in turn were kept in sect. *Dolichophyllum* by Li in his Revision. On account of the strictly opposite (not verticillate) leaves and flowers, the almost woody habit and especially the straight corolla-tube, *P. binaria* Maxim. is very distinct from the two species of series *Pseudorostratae*, and by these characters it is better regarded as the type of a separate new series. Its systematic position is not with *Pseudorostratae*, which has a perennial and strictly herbaceous habit, 4-verticillate upper leaves and flowers, and a corolla-tube that bends forward at the apex, but is with the series *Debiles* ; therefore its accommodation in sect. *Brachyphyllum* is more satisfactory than in sect. *Dolichophyllum.*

Pedicularis fletcheriana Tsoong, sp. nov.

Radix cylindrica, subcarnosa, ramosa, ad 8 cm. longa, apice saepe fibrifera. *Caules* caespitosi, pauci vel plurimi (ad 10), laterales prostrato-adscendentes, medii erecti, glabri. *Folia* omnia petiolata, radicalia pauca, petiolis 2·5 cm. longis ; lamina oblonga, 8 cm. longa, 2 cm. lata, circa 7-jugatim pinnatisecta, pinnis distantibus pinnatipartitis oblongo-ovatis, circa 1 cm. longis, 7 mm. latis, iterum argute et irregulariter serratis, dentibus callosis. *Folia* caulina minora et brevius petiolata, petiolis basi dilatatis. *Flores* omnes axillares, inferiores distantes, superiores contigui, bracteas vix superantes. *Calyx* cylindricus, 23 mm. longus, externe longe pilosus, antice ad 1/4 fissus, dentibus saepe coehaerantibus, 2 vel 4, foliaceis, 5–6 mm. longis, fere ac latis, ovatis, in lobos 2–4-jugos argute serratos profunde pinnatifidis. *Corollae* tubus 2·2 cm. longus, glaber; galeae pars verticalis circa 6 mm. longa, leviter reflexa (non incumbens), pars antherigera fere aequilonga, apice in rostrum breve conicum circa 3 mm. longum profunde bilobum attenuata ; labium inferum magnum, galeam multo excedens, circa 16 mm. longum 20 mm. latum, lobo medio quam lateralibus leviter longiore, oblongo, 8 mm. longo, 5·5 mm. lato, apice ut in lateralibus paulo latioribus leviter retuso. *Filamenta* ad medium tubi inserta, anticis leviter pilosis.

BHUTAN : Below Singhi Dzong, 2,438 m. ; 21st July, 1949, *Ludlow, Sherriff & Hicks 21312.* Lao (Trashi-yangse Chu), N.E. Bhutan, 2,743 m.,; 5th July, 1949, *Ludlow, Sherriff & Hicks 20480.*

S.E. TIBET : Chayul Chu, Chayul, 3,353 m. ; 24th July, 1936, *Ludlow & Sherriff 2427.* Kyimpu, Chayul-Charme road, Charme 3,960 m. ; 26th July, 1936, *Ludlow & Sherriff 2444.* Char Chu, Charme, 3,120 m. ; 2nd July, 1936, *Ludlow & Sherriff 2269.* Lilung, Tsangpo Valley, Kongbo, 3,048 m. ; 1st July, 1938, *Ludlow, Sherriff & Taylor 5712.* Singo Samba, near Molo, Kongbo, 3,505 m. ; 15th July, 1936, *Ludlow 1915.* Dzala, Pasum Chu, Kongbo, 3,810 m. ; 2nd July, 1947, *Ludlow, Sherriff & Elliot 14058.* Bo La, 4,572 m. ; 9th September, 1947, *Ludlow, Sherriff & Elliot 15706.* Lusha Chu, Kongbo, 3,505 m. ; on mossy bank of river ; lower lip of corolla erect, white with flush of purple on palate, enclosing the galea ; galea broadly curved, reddish purple at base, suffused pale purple ; 15th June, 1938 ; *Ludlow, Sherriff & Taylor 4828* (holotype in Herb. Brit. Mus.). Deyang, Kongbo, 2,896 m. ; 28th July, 1938, *Ludlow, Sherriff & Taylor 5455.*

This new species is allied to *P. aschistorhyncha* Marquand & Shaw, *P. klotzschii* Hurusawa (*P. macrantha* Klotzsch, non Sprengel) and *P. sculleyana* Prain. From the first, with which it agrees in the shape of the calyx with two large foliaceous teeth and cylindric tube, it can be readily recognized by its deeply cleft beak. From the second, which is less closely related, it differs in the foliaceous calyx-teeth, the bigger lower lip and the shorter but more deeply cleft beak. From the third, its closest ally, it differs in the usually shorter and broader leaves, in the much shorter inflorescence, in the two foliaceous instead of five short calyx-teeth, in the narrower lobes of the lower lip and especially in the more highly split beak, the cleft of which passes far beyond its own length, to reach as far as the front of the galea.

This new species was first brought to my notice by Dr. H. R. Fletcher, of the Royal Botanic Garden, Edinburgh, who kindly sent me some living material for identification. This came from a plant raised at Keillour Castle, Perthshire (from seeds under the number *Ludlow, Sherriff & Elliot 15824*) by Major and Mrs. Knox Finlay, who, at my request, kindly sent me additional material, including radical leaves. The description is, however, drawn from the abundant herbarium material cited above, for this species is very common in south-eastern Tibet and Bhutan. According to Major Finlay, the plant was for a time established by seed in his garden and freely reproduced itself. It seems that some members of the genus which have less exact environmental requirements may be easily raised from seed and brought into cultivation, a fact both interesting and encouraging, for it makes possible experimental studies hitherto regarded as hopeless because of the semi-parasitic and saprophytic nature of the genus.

Pedicularis subulatidens Tsoong, sp. nov. (Ser. *Oxycarpae*)

Herba humilis, vix 7 cm. alta. *Radiculae* plurimae, filiformes et fusiformes intermixae, ad 6 cm. longae. *Caulis* singulus, dense glanduloso-pubescens, efoliatus vel rarius unifoliatus, basi squamis lanceolatis paucis obsitus. *Folia* radicalia longe petiolata, petiolis ad 2 cm. longis, laxe pilosis ; lamina oblongo-lanceolata, 17 mm. longa, 7 mm. lata, 6–8-jugatim pinnatisecta, segmentis ovato-oblongis usque ovatis circa 3 mm. longis. *Inflorescentia* subcapitata floribus circa 5–8 congestis, inferioribus ad 7 mm. pedicellatis, superioribus sessilibus. *Calyx* antice ad medium fissus, tubo vix 4 mm. longo, apice tridentato dente postico subulato 2 mm. longo reliquiis paulo longioribus apice levissime dilatatis serratisve. *Corollae* tubus 11–14 mm. longus, vix 1 mm. diametro, externe pubescens ; galea ad basim partis antherigerae valde contorta ut in *P. hookeriana* Wall., 6 mm. longe rostrata ; labium inferum cordatum, 11 mm. longum, 13 mm. latum, profunde trilobatum lobo medio lateralibus fere dimidio minore. *Filamenta* ad trientem superiorem tubi inserta, omnia glaberrima, loculis apiculatis.

S.E. TIBET : Ata Kang La, Zayul, 3,960–4,260 m. ; on alpine turf slopes, wherever there is a more or less continuous carpet of vegetation ; flowers crimson-purple ; 11th July, 1933, *F. Kingdon-Ward 10573* (holotype in Herb. Brit. Mus.).

This species is near *P. tibetica* Franch. but differs in being of much smaller stature, with much smaller leaves but longer-tubed flowers. There is also a possibility of its being a relative of *P. hookeriana* Wall. of the series *Longiflorae*, but the tube of the flower is far too short and the inflorescence shows no trace of being centrifugal.

PEDICULARIS DENSISPICA Franch. ex Maxim. in *Bull. Acad. Imp. Sci. St.-Pétersb.* xxxii : 594, fig. 111 (1888).

Subsp. **schneideri** (Bonati) Tsoong, comb. nov.

P. densispica var, *schneideri* Bonati in *Notes R. Bot. Gard. Edinb.* xiii : 133 (1921).

Subsp. **viridescens** Tsoong, subsp. nov.

A subsp. *schneideri* recedit planta praesertim glabra, corolla majore ad 16 mm. longa, galea siccitate flavo-viridescentia.

S.E. TIBET : Tsogo, Pasum Tso, Kongbo, 3,597 m. ; border of cultivation ; calyx green, corolla pale pink ; 18th June, 1947, *Ludlow, Sherriff & Elliot 13924* (holotype in Herb. Brit. Mus.).

Pedicularis porriginosa Tsoong, sp. nov.

Herba perennis. *Rhizoma* verticale, nodosum, radiculis fibrosis ad nodos fasciculatis. *Caulis* singulus, simplex vel rarius parce ramosus, ad basim squamis linearibus paucis ornatus, 7–20 cm. altus, 4-fariam sub-adpressa pubescens. *Folia* radicalia saepe evanida, ad 2 cm. petiolata ; lamina perparva obata, 5 mm. longa, 3 mm. lata. *Folia* caulina opposita, 1–3 paria, inferiora longius superiora brevius petiolata, quam radicalia multo majora, utrinque albofurfuracea, 15–35 mm. longa, 7–12 mm. lata, oblongo-lanceolata vel lanceolata, acuta, pinnatipartita, rhachide alata, segmentis 6–12-jugis lineari-oblongis margine inciso-serratis dentibus cartilagineis. *Flores* numerosi, inferiores in axillis foliorum valde distantes, superiores contigui. *Calyx* subcylindricus, externe parce pilosus, tubo 2 mm. longo, dentibus saepe plus minus confluentibus plerumque 4, triangularibus usque triangulari-lanceolatis, apice vix dilatatis, subintegris. *Corollae* tubus 11 mm. longus, glaber, ad 1/3 sursum inflatus ; galea vix 3 mm. longa, erostrata ; labium inferum leviter stipitatum, profunde trifidum, lobis omnibus oblongis, lobo medio quam lateralibus vix minore. *Filamenta* dense pilosa.

BHUTAN : Rinchen Chu, 4,725 m. ; on grass-covered cliff-ledges ; perianth wine-red with dark purple spots and striations ; leaves dull green, with a white woollen substance on both sides ; 13th July, 1937, *Ludlow & Sherriff 3442* (holotype in Herb. Brit. Mus.). Omta Tso, 4,572 m. ; 11th August, 1949, *Ludlow, Sherriff & Hicks 17113*.

A species marked by small basal but much larger cauline leaves, the white snowy scurf on both sides of the leaves, the short galea similar to that of *P. spicata* Pall. of the series *Verticillatae*, the large, deeply lobed lower lip, and the tube which is bent forward in the upper mid-portion. In floral characters, this is very near *P. salicifolia* Bonati except for the bent tube ; in the vegetative characters it is, however, very different. It should constitute the type of a new series. Owing to its ambiguous floral structure, its systematic position is very difficult to fix ; it is kept near series *Abrotanifoliae* for the time being.

Pedicularis rhynchotricha Tsoong, sp. nov. (Ser. *Pectinatae*)

Herba elata, inferne glabra, superne 4–5-fariam pubescens. *Radices* subfusiformes, plurimi, carnosi. *Caules* plurimi vel singuli, simplices, atri, ad 60 cm. alti, inferne teretes, superne striati. *Folia* radicalia evanida, caulina inferiora 4-natim, media superioraque 5-natim verticillata, verticillastris circa 7–9 ; petioli glabri, iis foliorum inferiorum ad 15 mm. longis, iis foliorum superiorum brevioribus vel fere nullis ;

lamina supra secus nervum medium pubescentia cetera glabra, reticulata, inferiora minora, 16 mm. tantum longa, media superioraque majora, 7 cm. longa, 3 cm. lata, ambitu lanceolato-oblonga, acuminata pinnatipartita, rhachide alato, segmentis 6–10-jugis linearibus 4–17 mm. longis, 4 mm. latis, iterum serratis. *Inflorescentia* elongata, centripeta, floribus in fasciculos interruptos circa 8–12 dispositis, bracteis linearibus inferioribus argute serratis superioribus fere integris omnibus flores superantibus. *Calyx* cylindricus, 9 mm. longus, 2·5 mm. latus, dentibus 5, quorum 1 summo filiformi paulo minore, reliquiis lanceolatis apicem versus leviter dilatatis vix serratis 3 mm. longis. *Corollae* tubus 9 mm. longus, glaber ; labium inferum ellipticum margine ciliatum basi rotundatum nec attenuatum apice rotundatum subtiliter trilobatum, lobo medio paulo minore ; galeae pars verticalis 4 mm. longa, margine antice longe ciliata, pars antherigera 4 mm. longa, 2 mm. lata, sensim in rostrum ea longius tenue (1 cm. longum) sigmoideum in parte medio densissime brunneo-villosum apice integrum attenuata. *Filamenta* in triente superiore tubi inserta, ad insertionem longe denseque pilosa, ceterum fere glabra. *Stylus* leviter exsertus.

S.E. TIBET : Pasum Tso, Kongbo, 3,597 m. ; on moist ground ; calyx green, corolla violet with long violet tube ; 21st July, 1947, *Ludlow, Sherriff & Elliot 15501* (holotype in Herb. Brit. Mus.). Je, Pasum Tso, Kongbo, 3,652 m. ; 7th July, 1947, *Ludlow, Sherriff & Elliot 14086.* Valley above Tripe, Kongbo, 3,353 m. ; 25th July, 1938, *Ludlow, Sherriff & Taylor 5395.* Kulu Phu Chu, near Paka, Kongbo, 3,505 m. ; 28th July, 1938, *Ludlow, Sherriff & Taylor 5983.*

As a species of the series *Pectinatae*, this is unique in possessing a long beak which is densely tomentose at the middle portion. Here also belong specimens collected by Kingdon Ward (*No. 6167*)[1] in the Eastern Himalaya : Atsa Pass, on alpine turf slopes, 27th August, 1924. ' Flower crimson, darker in the centre ; tube hairy."

PEDICULARIS PYRAMIDATA Royle in Benth., *Scroph. Ind.* : 52 (1835).

Subsp. **multiflora** (Pennell) Tsoong, comb. nov.

P. multiflora Pennell, *Scroph. West Himal.* : 139, pl. 24,A. (1943).

KASHMIR : Gund, Sind Valley, 1,829 –2,134m. ; 15th August, 1940, *Ludlow & Sherriff 7949.*

The difference between *P. pyramidata* Royle and *P. multiflora* Pennell is insufficient for specific distinction and it is convenient to unite the latter with the former as a subspecies.

PEDICULARIS OLIVERIANA Prain in *Journ. As. Soc. Bengal* lviii, 2 : 257 (1889).

Subsp. **lasiantha** Tsoong, subsp. nov.

A typo praecipue pilis longis secus lineam dorsalem corollae differt. Habitus saepe validior, valde ramosus ; folia 4–6-natim verticillata, lamina ad 7 cm. longa,

---

(1) *Ward 6167* in Edinburgh Herbarium is a mixed sheet. Two small plants at the right side belong to another species, being apparently a member of the series *Paucifoliatae*. It is unfit for identification on account of the poor material, and is designated as *6167a*.

2 cm. lata, 12–15-jugo pinnatisecta; inflorescentia valde interrupta, ad 20 cm. longa; rostrum 8–10 mm. longum.

S.E. TIBET: Gyantse; 1924, *Ludlow 36.* Hills north of Lhasa, 3,960 m.; 10th July, 1942; *Ludlow & Sherriff 8811.* Sang, Kongbo, 2,896 m.; 25th June, 1938, *Ludlow, Sherriff & Taylor 4986* (holotype in Herb. Brit. Mus.). Sanga Choling, Charme 3,353 m.; 1st July, 1936, *Ludlow & Sherriff 2268.* Molo, Kongbo, 3,200 m.; 24th June, 1938, *Ludlow, Sherriff & Taylor 5657.* Molo, Lilung Chu Valley, Kongbo, 3,414 m.; 22nd June, 1936, *Ludlow & Sherriff 1851.*

This subspecies in its extreme form certainly looks very different from typical *P. oliveriana.* The long hairs on the dorsal line of the corolla and the comparatively elongate beak are distinct enough, not to mention the more numerous pinnae of the leaves. Although the hairs on the dorsal suture of the flowers are mentioned neither by Prain nor by other authors, an examination of the type specimen reveals some faint traces of them; in some autheticated specimens the hairs are very prominent. As all these variations are presented in transitional stages, I prefer to describe it merely as a subspecies.

Pedicularis mucronulata Tsoong, sp. nov. (Ser. *Rudes*)

Herba ultra 60 cm. alta, undique albo-pubescens, haud nigrescens. *Caulis* singulus, simplex, crebre foliatus. *Folia* omnia caulina, utrinque leviter pubescentia, ambitu lineari-lanceolata, ad 55 mm. longa, 11 mm. lata, basi cordato-amplexicaulia, apice obtusiuscula, profunde pinnatisecta, segmentis circa 15-jugis, oblongis usque triangulari-ovatis, argute duplicato-serratis, superioribus gradatim in bracteas plus minusve imbricatas basi late ovatas apice acuminatas fere integras transformatis. *Inflorescentia* racemosa, 10–15 cm. longa. *Calyx* pubescens, tenuissimus, crebre reticulatus, vix 12 mm. longus, dentibus 5 late deltoideo-ovatis acutis. *Corolla* lutea, tubo calycem superanti 15 mm. longo; labium inferum basi longe cuneatum, 11–14 mm. longum, 10–12 mm. latum, ad medium trilobum, lobo medio rotundato iis lateralibus ovato-ellipticis fere duplo latiore, omnibus longe ciliatis apice cuspidatis; galeae pars verticalis circa 6 mm. longa, pars antherigera fere horizontaliter decurva, dense villosa, sensim in rostrum late conicum apice fere truncatum attenuata. *Filamenta* omnia glabra. *Stylus* paulo exsertus vel fere inclusus.

BHUTAN: Below Senghi Dzong, 2,438 m.; on open hill slopes amongst small bushes; flower pale yellow; 21st July, 1949, *Ludlow, Sherriff & Hicks 21313* (holotype in Herb. Brit. Mus.).

The nearest ally of this new species among species already known is to be found in *P. clarkei* Hook. f. which it resembles in general appearance. However, the three almost equal narrow-lanceolate lobes of the lower lip in *P. clarkei* at once distinguish it from the present species. The real affinity seems to be with *P. imbricata* described immediately below. The distinction lies in the mid-lobe of the lower lip which is rounded and nearly twice as broad as the lateral lobes. In vegetative characters the width of the cauline leaves of this species is only one-third to a quarter of that in the other species.

Pedicularis imbricata Tsoong, sp. nov. (Ser. *Rudes*)

Herba elata pubescens. *Rhizoma* ramosum, incrassatum, ramis subfusiformibus ad 16 mm. diam., collo radicibus fibrosis dense caespitosis cincto. *Caules* 1–2, simplices, erecti, ad 70 cm. alti, fistulosi striati. *Folia* omnia caulina, basi truncato-cordata, subamplexicaulia, apice acuta, ambitu oblongo-lanceolata, 7 cm. longa, 22 mm. lata, ad 2/3 pinnatifida, segmentis 13–19 jugis, oblongo-lanceolatis usque ovatis, margine inciso-dentatis lobulatisve, utrinque glabra. *Inflorescentia* ad 30 cm. longa, bracteis inferioribus foliaceis, mediis superioribus late obatis caudato-acuminatis arcte imbricatis prominentissimis, flore brevioribus. *Calyx* 15 mm. longus, membranaceus, reticulatus, laxe pilosus, tubo 12 mm. longo, dentibus 5 subaequalibus deltoideis 3–5 mm. longis. *Corollae* tubus 13 mm. longus, glaber; galeae pars verticalis 5 mm. longa, pars antherigera 6 mm. longa, dorso laxe pilosa, secus marginem inferiorem valde involutem dense trichomata, apice in rostrum ei paulo breviore sensim attenuata; labium inferum circa 12 mm. longum, 7 mm. latum, antice ad 1/3 in lobos 3 divisum, cujus medio elliptico lateralibus lanceolatis acutis fere duplo latiore. *Filamenta* omnia glabra. *Capsulae* obovatae vix apiculatae, 16 mm. longae, 9 mm. latae, valvis ad medium longitudinaliter canaliculatis, seminibus compressis ovato-ellipticis, 3–3·5 mm. longis, 2·5 mm. latis, pallidis, perforate reticulatis.

BHUTAN: Ju La, Bumthang Chu, 4,260 m.; amidst grass in shrubbery; calyx wine-red; corolla white with a wine-red upper lip; 20th July, 1949, *Ludlow, Sherriff & Hicks 16914* (holotype in Herb. Brit. Mus.).

A near relation of *P. clarkei* Hook. f., from which this new species can be easily distinguished by the generally broader leaves with closer-set longer pinnae, the broad-ovate closely imbricate bracts shorter than the flowers and the galea with involute margin along which there is a dense fringe of hairs. In general aspect, it recalls *P. cinerascens* Franch., but that species has long-stipulate lobes on the lower lip, and is also much smaller in size with shallowly lobed leaves.

Pedicularis platychila Tsoong, sp. nov. (Ser. *Rudes*)

Herba ultra 40 cm. alta, inferne laxius, superne densius crispato-pubescens, sicco nigrescens. *Folia* inferiora evanida, caulina oblongo-lanceolata, inferiora superioraque minora, media ad 6 cm. longa, 15 mm. lata, utrinque plus minus crispato-pubescentia, basi cordato-amplexicaulia, apice obtusiuscula, ad medium laminae vel paulo ultra pinnatipartita, segmentis circa 15-jugis, 3–6·5 mm. longis, and 4 mm. latis, margine lobulatis, lobulis iterum argute cartilagineo-serratis. *Inflorescentia* terminalis, bracteis foliaceis; flores inferiores distantes superiores contigui. *Calyx* amplus, ad 15 mm. longus, dense pubescens, antice haud fissus, apice 5-dentatus, dentibus subaequalibus triangularibus integerrimis 3–4 mm. longis fere ac latis ut tubo crebre reticulatis. *Corollae* tubus calyce aequilongus glaber; labium inferum ambitu transverse ellipticum, circa 9 mm. longum, 10–12 mm. latum, basi valde cuneatum substipitatum, subaequaliter trilobatum, lobo medio paulo quam lateralibus majore, omnibus ovatis obtusiusculis margine ciliatis; galeae pars verticalis circa 5 mm. longa, pars antherigera adscendentia, externe ut margine antice longe pilosa, apice in rostrum inconspicuum plus minus erosum sensim attenuata. *Filamenta* omnia glabra. *Stylus* longe exsertus.

ASSAM : Ze La, 4,260 m. ; scattered on the steep rocky alpine slopes amongst dwarf rhododendrons ; flowers pale yellow, calyx very hairy, almost woolly ; a tall, erect, single-stemmed species ; 19th August, 1938, *F. Kingdon-Ward 14119* (holotype in Herb. Brit. Mus.).

A species nearest *P. clarkei* Hook.f., but distinct in possessing an ascending instead of an incurved galea, which is somewhat erose at the apex, and a lower lip broader than long with wide lobes, this resembling in general that of *P. rudis* Maxim. which has, however, a very differently shaped galea.

Pedicularis angustiloba Tsoong, sp. nov. (Ser. *Craspedotrichae*)

Herba elata, ad 70 cm. alta, praeter inflorescentiam satis pubescentem fere glabra, nigrescentia. *Rhizoma* incrassatum collo radicibus fibrosis brevibus cincto. *Caulis* simplex, erectus, fistulosus, dense foliatus. *Folia* radicalia mox evanida, caulina lanceolato-linearia, basi amplexicaulia, apice acuta, margine subtiliter pinnatifida, 7 cm. longa, 7 cm. lata, segmentis 27–40-jugis, iterum dupliciter serratis, supra nitida, subtus opaca. *Inflorescentia* 10–25 cm. longa, bracteis foliaceis, flores superantibus. *Calycis* tubus 6 mm. longus, externe albo-pilosus, mediocriter reticulatus, dentibus 5, subaequalibus, triangulari-lanceolatis, 4 mm. longis, subintegris. *Corollae* tubus calyce vix aequans, circa 9 mm. longus, externe glaber ; galea arcuata, ad medium inflata, margine antice laxe trichomata, apice rostrata, rostro 1·5 mm. longo, incurvo ; labium 14 mm. longum, 8–9 mm. latum, basi valde cuneatum, antice sensim dilatatum, fere ad medium in lobos 3 ovato-oblongus apicem versus erosos acutos fissum, margine plus minusve ciliatum. *Filamenta* ad medium tubi inserta, anticis densius posticis laxius pilosis.

S.E. TIBET : Nambu La, 3,810 m. ; 10th July, 1947, *Ludlow, Sherriff & Elliot 15364*. Tamnyen La, Kongbo, 3,353 m. ; on loose moraine scree ; up to 2 ft. ; corolla greenish yellow, galea spotted dark purple and hairy at the margin on the median swollen part ; leaves deep purple below ; 22nd June, 1938, *Ludlow, Sherriff & Taylor 4938* (holotype in Herb. Brit. Mus.). Deyang La, Kongbo, 4,115 m. ; 11th August, 1947, *Ludlow, Sherriff & Elliot 14321*.

This species can be easily distinguished from all the known species of the series *Craspedotrichae* by its strongly cuneate lower lip, divided into three ovate-oblong lobes, and the extremely short corolla-tube, the like of which is only found in *P. steiningeri* Bonati, but that species has a very differently shaped lower lip. In fact, among its allies with narrow, linear, shallowly-toothed leaves, such as *P. ingens* Maxim., *P. pseudoingens* Bonati, *P. steiningeri* Bonati, *P. pseudosteiningeri* Bonati, *P. tongolensis* Franch., etc., this is the only species having the lower lip narrowly trilobed, in which character it approaches *P. clarkei* Hook. f. whose general habit, however, places it in the series *Rudes*.

Pedicularis kongboensis Tsoong, sp. nov.

Herba elata, simplex vel ramosa, undique pubescens. *Rhizoma* crassum, ad 1 cm. diametro, apice radicibus fibrosis cinctum. *Caules* nigrescentes, validi, 30 usque 110 cm. alti. *Folia* linearia vel lineari-lanceolata, 3–12 cm. longa, 2·5–13 mm. lata, pinnatifida, lobis triangulari-ovatis usque ovatis circa 30 paribus, margine antice argute duplicato-serratis, dentibus cartilagineis, initio laxe pubescentia mox glabrescentia. *Inflorescentia* spicata, continua vel ad basim interrupta, 10 usque 50 cm. longa, pubescentia. *Calyx* pubescens, tubo 7–8 mm. longo, haud fisso, dentibus 5, subaequalibus triangularibus acuminatis, ut tubo membranaceis prominente reticulatis, 3–5 mm. longis, margine denticulatis vel fere integris. *Corollae* tubus calyce subaequalis vel paulo longior, circa 11–15 mm. longus, glaber ; galea angustata, parte verticali incumbente vix 3 mm. longa, margine antice trichomatibus longis subdense ciliata, apice in rostrum continuum valde elevatum apice acutum 7–8 mm. longum producta ; labium inferum quam galea manifeste breviore, 10–13 mm. longum, 8 mm. latum, basi lobos magis attenuatos subaequales margine laxe sed longe ciliatos divisum. *Filamenta* supra dimidium tubi affixa, antice dense pilosis. *Stylus* apice plus minus circinatus, exsertus.

S.E. TIBET : Kulu Phu Chu, near Paka, Kongbo, 3,960 m. ; on open very steep hillside ; 1½–3½ ft. high ; galea shiny dark wine-red, remainder of perianth very pale yellow ; calyx dark wine-red with white hairs ; leaves green to dull crimson, 27th July, 1938 ; *Ludlow, Sherriff & Taylor 5956* (holotype in Herb. Brit. Mus.). Penam Chu, near Je, Pasum Tso, Kongbo, 3,960 m. ; 11th July, 1947, *Ludlow, Sherriff & Elliot 14122.*

This constitutes an unusually interesting discovery within the group *Sceptrum.* With its membranaceous reticulate calyx having sub-entire elongate-triangular teeth, its short corolla-tube and its peculiar lower lip deeply divided into lanceolate lobes, it almost certainly has evolved directly from *P. angustiloba* of approximately the same region. The galea is almost on a par with those of *P. excelsa* Hook. f. and *P. viali* Franch. Although the floral characters show relationship to each other, the vegetative features of the two last-named species are closer to series *Rudes* with highly lobed broad leaves, while that of the present species is clearly with series *Craspedotrichae* in having linear, shallowly lobulate leaves. This, in connection with its variety and the next new species, *P. retingensis*, has to be kept in a separate new series.

Var. **obtusata** Tsoong, var. nov.

A typo recedit calycis tubo breviter laxiusque reticulato, corollae labii inferioris lobis latioribus obtusiusculis.

S.E. TIBET : Dzeng, Gyamda Chu, Kongbo, 2,987 m. ; on banks in Ilex forest ; corolla purplish red on upper lip, yellow on under lip ; style purplish red, stigma green ; bracts green 13th August, 1938, *Ludlow, Sherriff & Taylor 6829* (holotype in Herb. Brit. Mus.).

Pedicularis retingensis Tsoong, sp. nov.

Herba elata, perennis. *Rhizoma* crassum, ad 1 cm. diam., apice radices fibrosa emittens. *Caules* nigrescentes, validi, haud ramosi, hirsuti, 30 usque 80 cm. alti.

Folia linearia vel lineari-lanceolata, basi truncata cordatave amplexicaulia, apice acuta vel acuminata, 5–8 cm. longa, 5–8 mm. lata, pinnatifida, lobis triangulari-ovatis vel ovatis circa 30 paribus margine antice argute serratis, utrinque fere glabra. *Inflorescentia* spicata, continua, 10 usque 30 cm. longa, bracteis foliaceis flores superantibus. *Calyx* glaber vel ad dentes laxissime longe pilosus, 8–10 mm. longus, haud fissus, tubo laxissime vel vix reticulato, dentibus 5, plus minus inaequalibus triangularibus vel triangulari-lanceolatis integris. *Corollae* tubus vix e calyce exsertus, 9 mm. longus, glaber; galea angusta, parte basali incumbente vix 3 mm. longa, margine antice trichomatibus longis subdense ciliata, apice in rostrum continuum leviter elevatum apice acutum producta; labium inferum quam galea manifeste breviore, 10 mm. longum, 8 mm. latum, basi valde cuneatum substipitatum, antice 2/3 in lobos 3 ovato-lanceolatos subaequales margine laxe ciliatos diviso. *Filamenta* prope basim tubi affixa, anticis plus minus pilosis. *Stylus* apice plus minus circinatus, infra apicem rostri exsertus.

S.E. TIBET: Reting, 60 miles north of Lhasa, 4,260 m.; on dry stony hill-sides; flowers cream with deep purple centre; 24th July, 1944, *Ludlow & Sherriff 11060* (holotype in Herb. Brit. Mus.). Reting, 60 miles north of Lhasa, 4,572 m.; 20th July, 1942, *Ludlow & Sherriff 8835*.

This is closely allied to *P. kongboensis*, but differs chiefly in the much smaller, dark-coloured, opaque not membranaceous calyx with scarcely any reticulation and in the shorter and less highly raised beak. The anterior filaments are also less hairy.

Pedicularis petelotii Tsoong, sp. nov. (Ser. *Aloenses*)

Herba elata, ramosissima. *Radix* fibrosa. *Caules* validiusculi, basi satis lignosi, cylindrici, brunneo-tomentelli. *Folia* opposita, omnia caulina, longe petiolata, petiolis ad 3 cm. longis, sparse pilosis; lamina 3 cm. longa, fere ac lata, pinnatisecta, segmentis 2–5-jugis, elliptico-oblongis usque ellipticis, 15 mm. longis, 8 mm. latis, vel in foliis inferioribus bipinnatisecta, segmentis secondariis 3–5-jugis, lineari-oblongis, 4 mm. longis, iterum pinnatifidis vel profunde duplicato-serratis dentibus longe setaceis saepe incurvis. *Flores* in axillis foliorum superiorum solitarii, 3 mm. longe pedicellati. *Calyx* 5·5 mm. longus, antice manifeste fissus, dentibus 5 deltoideis perparvis. *Corollae* tubus 17 mm. longus, cylindricus, glaber; galea leviter falcata, apice edentata, 7–8 mm. longa, circa 2·5 mm. lata; labium inferum 7 mm. longum, erectum vel vix patens, ad 2/5 in lobos 3 longe ciliatos divisum, lobo medio quam lateralibus ovato-acutis duplo latiore, ambitu ovato obtusissmo, plicis 2 satis elevatis praedito. *Filamenta* antica brunneopilosa, cetera glabra. *Stylus* breviter exsertus. *Capsulae* triangulari-lanceolatae, acuminatae, 10 mm. longae, 2·5 mm. latae.

CHINA: Province unknown, "Massives de Fan Tsi Pan, Route du col de Li Qui Ho, 1,800 m.; July, 1927, *A. Petelot 5111* (holotype in Herb. Brit. Mus.).

I am unable to trace the locality to which the above citation refers. This species is a very characteristic one and is easily distinguishable from the other species of the series *Aloenses*. The long setaceous-toothed pinnae of the leaves and the woody tomentellous stem enable it to be recognized even in a sterile condition. In floral

characters it is remarkable for its split calyx, its very long corolla-tube and its dark-hairy anterior filaments.

PEDICULARIS PLICATA Maxim. in *Bull. Acad. Imp. Sci. St.-Pétersb.* xxxii : 598, fig. 120 (1888).

Var. **apiculata** Tsoong, var. nov.

P. cheilanthifolia sensu Marquand & Shaw in *Journ. Linn. Soc. London, Bot.* xlviii : 211 (1929) ; non Schrenk.

A typo recedit galea manifeste cristata, infra apicem distincte apiculata.

S.E. TIBET : Drukla Gompa, near Shoga Dzong, Kongbo, 3,505 m. ; 19th August, 1938, *Ludlow, Sherriff & Taylor 6855.* Ba La, Pasum Chu, Kongbo 4,115 m. ; gravelly river bed ; calyx pale green, corolla white spotted purple at tip ; 1st July, 1947, *Ludlow, Sherriff & Elliot 14038* (holotype in Herb. Brit. Mus.). Nambu La, Kongbo, 4,260 m. ; 12th July, 1947, *Ludlow, Sherriff & Elliot 15393 A.*

Here also belongs *Kingdon Ward 6116*, likewise from Drukla Gompa, referred to *P. cheilanthifolia* Schrenk by Marquand and Shaw, and his number *12229* from Upper Yigrong Valley.

This variety differs from the type in having a more prominently crested and apiculate galea ; in these characters it approaches closely *P. globifera* Hook. f. The colour of flowers evidently varies from whitish to sulphur yellow as indicated by the field notes.

Pedicularis siamensis Tsoong, sp. nov. (Ser. *Rigidae*)

Herba elata, pubescens, radicibus caespitosis fibrosis. *Caules* lignosi, ad 7 mm. diam., subquadangulari, fistulosi, ramosissimi, ramis ad 25 cm. longis, divaricatis, 4-natim verticillatis. *Folia* omnia caulina, in caule principali 4-natim, in ramis vulgo 3-natim verticillata, profunde (i.e. fere ad costam mediam) pinnatisecta, segmentis 8–13-jugis linearibus grosse duplicato-serratis dentibus cartilagineis, margine revolutis, utrinque sparse setuloso-pubescentia. *Inflorescentia* terminalis racemosa, bracteis foliaceis minoribus. *Flores* 3-natim verticillati vel superiores bini et oppositi. *Calyx* pubescens, 6 mm. longus, antice vix fissus, dentibus 5, triangulari-lanceolatis distincte cartilagineo-serratis circa 1·5 mm. longis. *Corollae* tubus circa 15 mm. longus, sursum sensim ampliatus ; galea leviter arcuata, 8–9 mm. longa, infra apicem argute bidentata ; labium inferum 12 mm. longum, 10 mm. latum, margine eroso-denticulatum, trilobatum, lobo medio elliptico- vel sub-rotundato, acutiusculo, lateralibus elliptico-oblongis plus duplo minore. *Filamenta* omnia glabra. *Capsulae* late ovatae, apiculatae, 10 mm. longae, 7 mm. latae ; semina oblonga, 2·5 mm. longa, 0·1 mm. lata, longitudinaliter striata, brunnea.

SIAM : Doi Chingdao, 6,400 m. ; open rocky ground ; flower purple, white incrustations on edge of leaf ; 6th November, 1922, *A. F. G. Kerr 6600* (holotype in Herb. Brit. Mus.).

A species nearest to *P. mairei* Bonati from which it differs in the much less finely dissected leaves and the manifestly elongated and serrate calyx-teeth.

Pedicularis shawii Tsoong, sp. nov. (Ser. *Verticillatae*)

P. roylei Maxim. var. *cinerascens* Marquand & Shaw in *Journ. Linn. Soc. London, Bot.* xlviii : 213 (1929).

A *P. roylei* differt praecipue radice magis incrassata carnosa ea *P. rupicolae* Franch. simillima ; quoque recedit indumento densiore, squamis basalibus crebrioribus, segmentis foliorum plus minus imbricatis branchiiformibus, etc.

Herba perennis, valde cinereo-pubescens. *Radix* singula, simplex vel ramosa, elongata, pinguis, ad 10 cm. longa, 8 mm. diam. ; caulium basis bracteis multis ovato-lanceolatis obtecta. *Folia* radicalia 20 mm. longa, 8 mm. lata, pinnis ovatis oblongisve plus minus imbricatis. Cetera ut in *P. roylei* Maxim.

S.E. TIBET : Sang La, Kongbo, 4,260 m. ; 29th June, 1938, *Ludlow, Sherriff & Taylor 5051.* Nyima La, Kongbo, 4,500 m. ; on alpine slopes amongst dwarf rhododendrons ; flower purple with upper lip darker ; 21st June, 1924 ; *F. Kingdon-Ward 5814* (holotype in Herb. Hort. Kew.).

PEDICULARIS ROYLEI Maxim. in *Bull. Acad. Imp. Sci. St.-Pétersb.* xxvii : 517 (1881).

Var. **brevigaleata** Tsoong, var. nov.

A typo speciei differt galea labio infero multo breviora.

BHUTAN : Me La, 4,260 m. ; 4th August, 1933, *Ludlow & Sherriff 388.*

S.E. TIBET : Tamnyen La, Tamnyen Chu, Kongbo, 3,505 m. ; 22nd June, 1938, *Ludlow, Sherriff & Taylor 4921* (holotype in Herb. Brit. Mus.). Deyang La, Kongbo, 3,960 m. ; 3rd June, 1947, *Ludlow, Sherriff & Elliot 15117a.*

Though in all respects well within the range of variation of the species, this has a much shorter galea than the type (var. *roylei*), a sure sign indicating higher attainment in floral development within the series *Verticillatae.* In general habit, it almost approaches *P. likiangensis* Franch., but that species differs in having different calyx-teeth and pilose filaments. Here also belongs *Kingdon-Ward 9936* from the Adung Valley of the Burma-Tibet Border.

PEDICULARIS DIFFUSA Prain in *Journ. As. Soc. Bengal,* lxii, 2 : 7, tab. 1 (1893).

P. diffusa differs from *P. verticillata L.* in the scarcely split calyx with almost equally spaced teeth.

Subsp. **elatior** Tsoong, subsp. nov.

Herba elata, ad 40 cm. alta, foliis floribusque multo majoribus quam in typo. Folia radicalia 4·5 cm. longa, caulina 4 cm. longa. Calyx 7–10 mm. longus. Corollae 17–20 mm. longa. Cetera ut in typo.

S.E. TIBET : Tamnyen La, Tamnyen Chu, Kongbo, 3,353 m. ; on gravelly stream banks ; perianth magenta pink galea tipped crimson, arched upwards and arcuate at apex ; 22nd June, 1938 ; *Ludlow, Sherriff & Taylor 4936* (holotype in Herb. Brit. Mus.).

This is a much more robust plant than typical *P. diffusa* Prain, with comparatively bigger leaves and flowers, but structurally it is not sufficiently different from the type to merit specific rank.

PEDICULARIS KANSUENSIS Maxim. in *Bull. Acad. Sci. St.-Pétersb.* xxvii : 516 (1881).

Subsp. KANSUENSIS

S.E. TIBET : Reting, 4,572 m. ; 11th July, 1944 ; *Ludlow & Sherriff 9967.*

Subsp. **villosa** Tsoong, subsp. nov.

A typo speciei differt tantum planta undique pilis albidis densissime villosa.

S.E. TIBET : Reting, 60 miles N. of Lhasa, 3,960 m. ; edge of water channels ; flowers reddish brown, 24th July, 1942, *Ludlow & Sherriff 8869* (holotype in Herb. Brit. Mus.).

PEDICULARIS SZETSCHUANICA Maxim. in *Bull. Acad. Imp. Sci. St.-Pétersb.* xxxii : 601, f. 125 (1888).

Subsp. **angustifolia** (Bonati) Tsoong, comb. nov.

P. szetschuanica var. *angustifolia* Bonati in *Bull. Herb. Boiss.*, ser 2, vii : 545 (1907).

S.E. TIBET : Besang Landup, Lochen Chu, 3,652 m. ; 28th August, 1947, *Ludlow, Sherriff & Elliot 15655.*

Pedicularis stenotheca Tsoong, sp. nov. (Ser. *Verticillatae*)

Herba perennis. *Radix* verticalis apice fibrosa. *Caules* pauci, circa 15 cm. alti, 4-fariam pilosi. *Folia* radicalia evanida, caulina 4-verticillata, inferiora longius (25 mm.) superiora brevius petiolata ; lamina lanceolata, ad 20 mm. longa, 10 mm. lata, pinnatipartita vel fere pinnatisecta, segmentis 6–9-jugis, ovatis usque lineari-lanceolatis, pinnatifidis, lobulis dentatis, supra fere glabra, subtus furfuracea pilis albidis munita. *Inflorescentia* brevis. *Calyx* 5 mm. longus, antice vix fissus, vix reticulatus, dentibus 5, postico triangulari integro, ceteris duplo majoribus ovatis serratis. *Corollae* tubus intra calycem infractus, 7 mm. longus ; galea circa 3 mm. longa, apice integra ; labium inferum 6 mm. longo, 8 mm. latum, trilobum, lobo medio minore *Filamenta* antica laxe pilosa. *Capsula* triangulari-lanceolata, acuminata, 15 mm. longa, 3·5 mm. tantum lata.

S.E. TIBET : Nambu La, Tongyuk River, Pome, 3,652 m. ; on grassy banks in conifer forest ; calyx green, corolla lilac ; 3rd June, 1947, *Ludlow, Sherriff & Elliot 13835* (holotype in Herb. Brit. Mus.).

A species very similar to *P. verticillata* L., *P. diffusa* Prain and *P. brachycrania* Li. The first agrees with our new species in the shape of the capsule, but differs in having a deeply split calyx with laterally congested teeth. The second and the third, which resemble it in the shape of flower, differ, however, in their broad capsules. In the flowering stage it may be a little difficult to distinguish the latter two species from *P. stenotheca,* although the indumentum on the underside of the leaves may afford some help in identification.

PEDICULARIS CHEILANTHIFOLIA Schrenk in *Bull. Phys.-Math. Acad. Sci. St. Pétersb.* 1 : 79 (1842).

Var. **albida** (Pennell) Tsoong, comb. nov.

P. albida Pennell, *Scroph. West. Himal.* 123 (1943).

KASHMIR : Zoji La, 3,960 m. ; 26th August, 1940, *Ludlow & Sherriff 8021.* Hemis Nullah, Leh, Ladak, 4,115 m. ; 4th July, 1941, *Ludlow & Sherriff 8461.*

The difference between *P. albida* Pennell and *P. cheilanthifolia* Schrenk is no more marked than that between *P. semenowii* Regel and *P. pycnantha* Boiss. When segregating *P. albida*, Pennell did not have enough material at hand. After having seen many specimens from Dzungaria, I am content to regard *P. albida* as merely a variety of *P. cheilanthifolia.*

BIBLIOGRAPHY

LI, HUI-LIN. 1948*a*. Some new Pedicularis from India and Burma. *Taiwania*, i : 83–92, pl. 1.

—— 1948*b*. A revision of the genus Pedicularis in China. Part 1. *Proc. Nat. Acad. Sci. Philadelphia*, c : 205–378, pls. 15–23.

—— 1949. A revision of the genus Pedicularis in China. Part 2. *Ibid.*, ci : 1–214, pls. 1–16.

MARQUAND, C. V. B. 1929. The botanical collections made by Capt. F. Kingdon Ward in the eastern Himalaya and Tibet in 1924–25. *Journ. Linn. Soc. London, Bot.* xlviii : 149–229.

PENNELL, F. W. 1943. *The Scrophulariaceae of the Western Himalayas.* Philadelphia.

PRAIN, D. 1889. Some additional species of Pedicularis. *Journ. As. Soc. Bengal*, lviii, 2 : 255–278.

—— 1890. The species of Pedicularis of the Indian Empire. *Ann. R. Bot. Garden, Calcutta*, iii : 1–196, pls. 1–37.

INDEX

It is not possible here to give a detailed enumeration with localities, heights, etc., of all the collections mentioned at the beginning of this paper which have been studied in its preparation apart from those representing new or nomenclatorially revised taxa. All the species represented are, however, listed below with indications of the regions in which the specimens have been collected. The list will thus serve as a bibliographical and geographical summary of the detailed enumeration deposited in the library of the Department of Botany, British Museum (Natural History).

P. alaschanica Maxim. in *Bull. Acad. Imp. Sci. St. Pétersb.* xxiv : 59 (1878).

P. alaschanica var. *tibetica* Maxim. in *Bull. Acad. Sci. Imp. St. Pétersb.* xxxii : 578 (1888). S.E. TIBET.

P. albiflora Prain in *Journ. As. Soc. Bengal*, lviii, 2 : 273 (1889). BHUTAN.

P. angustiloba Tsoong (p. 25). S.E. TIBET.

P. atroviridis Tsoong (p. 13). S.E. TIBET.

P. bella Hook. f. (p. 6).

P. bella subsp. *bella* (p. 6). S.E. TIBET.

P. bella subsp. *holophylla* (Marq. & Shaw) Tsoong (p. 6). S.E. TIBET.

P. bella subsp. *holophylla* var. *crestifrons* Tsoong (p. 6.) S.E. TIBET.

P. bicornuta Klotzsch in Klotzsch & Garcke, *Bot. Ergebn. Reise Prinz Waldemar.* : 109, t. 61 (1862). KASHMIR ; PUNJAB.

P. bifida (D. Don) Pennell, *Scroph. W. Himal* : 144 (1943). NEPAL. ; BHUTAN.

P. canescens Tsoong (p. 16). Kashmir.
P. cheilanthifolia Schrenk (p. 31).
P. cheilanthifolia var. *albida* (Pennell) Tsoong (p. 31). Kashmir.
P. clarkei Hook. f., *Fl. Brit. Ind.* iv : 840 (1885). Bhutan.
P. collata Prain in *Journ. As. Soc. Bengal* lviii, 2 : 290 (1889). Bhutan.
P. confertiflora Prain in *Journ. As. Soc. Bengal* lviii, 2 : 258 (1889). Nepal.
P. corydaloides Hand.-Mazz., *Symb. Sin.* vii : 851, t. 15 f. 4 (1936). S.E. Tibet.
P. cryptantha Marquand & Shaw (p. 4).
P. cryptantha subsp. *cryptantha*. S.E. Tibet.
P. cryptantha subsp. *erecta* Tsoong (p. 4). S.E. Tibet
P. daltonii Prain in *Journ. As. Soc. Bengal* lviii, 2 : 270 (1889). S.E. Tibet.
P. densispica Franch. (p. 20).
P. densispica subsp. *schneideri* (Bonati) Tsoong (p. 20). S.E. Tibet.
P. densispica subsp. *viridescens* Tsoong (p. 21). S.E. Tibet.
P. denudata Hook. f., *Fl. Brit. Ind.* iv : 309 (1885). Sikkim.
P. diffusa Prain (p. 29).
P. diffusa subsp. *elatior* Tsoong (p. 29). S.E. Tibet.
P. elephantoides Benth., *Scroph Ind.* : 53 (1835). Kashmir.
P. elliotii Tsoong (p. 13). S.E. Tibet.
P. elwesii Hook. f., *Fl. Brit. Ind.* iv : 312 (1885). Nepal ; Bhutan ; S.E. Tibet.
P. excelsa Hook. f., *Fl. Brit. Ind.* iv : 311 (1885). Bhutan.
P. filiculiformis Tsoong (p. 5).
P. filiculiformis var. *filiculiformis* (p. 5). S.E. Tibet.
P. filiculiformis var. *dolichorrhyncha* Tsoong (p. 5). Bhutan.
P. fletcheriana Tsoong (p. 19). Bhutan ; S.E. Tibet.
P. furfuracea Wall. ex Benth., *Scroph. Ind.* : 52 (1835). Nepal ; Bhutan.
P. garnieri Bonati in *Bull. Soc. Bot. France* lv : 243 (1908). S.E. Tibet.
P. gibbera Prain in *Journ. As. Soc. Bengal*, lviii, 2 : 262 (1889). Bhutan.
P. gracilis Wall. ex Benth., *Scroph. Ind.* : 52 (1835). Nepal ; Bhutan ; S.E. Tibet.
P. heydei Prain in *Journ. As. Soc. Bengal* lviii, 2 : 258 (1889). Kashmir.
P. hicksii Tsoong (p. 10). Bhutan.
P. hookeriana Wall. ex Benth., *Scroph. Ind.* : 53 (1835). Punjab : Bhutan.
P. imbricata Tsoong (p. 24). Bhutan.
P. integrifolia Hook. f., *Fl. Brit. Ind.* iv : 308 (1885). S.E. Tibet.
P. inconspicua Tsoong (p. 17). Bhutan.
P. kansuensis Maxim. (p. 30).
P. kansuensis subsp. *kansuensis* (p. 30). S.E. Tibet.
P. kansuensis subsp. *villosa* Tsoong (p. 30). S.E. Tibet.
P. klotzschii Hurusawa in *Journ. Jap. Bot.* xxii : 184 (1948). Nepal.
P. kongboensis Tsoong (p. 25).
P. kongboensis var. *kongboensis*. S.E. Tibet.
P. kongboensis var. *obtusata* Tsoong (p. 26). S.E. Tibet.
P. lachnoglossa Hook. f., *Fl. Brit. Ind.* iv : 311 (1885). S.E. Tibet.
P. latituba Bonati in *Bull. Soc. Bot. France* lv : 243 (1908). S.E. Tibet.
P. longiflora Rudolph (p. 7).
P. longiflora var. *tubiformis* (Klotzsch) Tsoong (p. 7). Kashmir ; Punjab ; Nepal ; Bhutan ; S.E. Tibet.
P. longipedicellata Tsoong (p. 8). Bhutan.
P. ludlowii Tsoong (p. 14). Bhutan.
P. lyrata Prain ex Maxim. in *Bull. Acad. Imp. Sci. St. Pétersb.* xxxii : 900 (1888). S.E. Tibet.
P. megalantha D. Don., *Prodr. Fl. Nepal.* : 94 (1825). Nepal ; Sikkim ; Bhutan ; S.E. Tibet.
P. megalochila Li (p. 7).
P. megalochila var. *megalochila*. S.E. Tibet.
P. megalochila var. *ligulata* Tsoong (p. 8). S.E Tibet.

P. megalochila f. *rhodantha* Tsoong (p. 8). Bhutan; S.E. Tibet.

P. merrilliana Li in *Proc. Acad. Nat. Sci. Philad.* ci : 96 (1949). Bhutan.

P. microcalyx Hook. f., *Fl. Brit. Ind.* iv : 315 (1885). Bhutan; S.E. Tibet.

P. mollis Wall. ex Benth., *Scroph. Ind.* : 52 (1835). Nepal; Bhutan; S.E. Tibet.

P. mucronulata Tsoong (p. 23). Bhutan.

P. muscoides Li in *Proc. Acad. Nat. Sci. Philad.* ci : 91, t. 10 f. 151 (1949). S.E. Tibet.

P. mychophila Marquand & Shaw in *Journ. Linn. Soc. London, Bot.* xlviii : 212 (1929). S.E. Tibet.

P. nana C. E. C. Fischer in *Bull. Misc. Inf. Kew* 1940 : 190 (1940). Nepal; Bhutan.

P. nepalensis Prain (p. 6).

P. nepalensis f. *nepalensis*. Nepal.

P. nepalensis f. *alba* Tsoong (p. 6). Bhutan.

P. oederi Vahl. (p 4.)

P. oederi subsp. *oederi* var. *oederi*. Kashmir.

P. oederi subsp. *oederi* var. *heteroglossa* Prain in *Journ. As. Soc. Bengal* lviii, 2 : 276 (1889). Nepal; S.E. Tibet.

P. oederi subsp. *branchiophylla* (Pennell) Tsoong (p. 4). Bhutan; S.E. Tibet.

P. oliveriana Prain (p. 22).

P. oliveriana subsp. *lasiantha* Tsoong (p. 22). S.E. Tibet.

P. pantlingii Prain in *Journ. As. Soc. Bengal,* lviii, 2 : 273 (1889). Bhutan; S.E. Tibet.

P. pectinata Wall. ex Benth., *Scroph. Ind.* : 52 (1835).

P. pectinata subsp. *pectinata*. Punjab.

P. pectinata subsp. *bipinnatifida* Pennell, *Scroph. W. Himal.* : 135, t. 21*b* (1943). Kashmir.

P. perpusilla Tsoong (p. 9). Bhutan.

P. petelotii Tsoong (p. 27). China.

P. platychila Tsoong (p. 24). Assam.

P. plicata Maxim. (p. 28).

P. plicata var. *apiculata* Tsoong (p. 28). S.E. Tibet.

P. polygaloides Hook. f., *Fl. Brit. Ind.* iv : 317 (1885). Bhutan.

P. poluninii Tsoong (p. 15). Nepal.

P. porrecta Wall. ex Benth., *Scroph. Ind.* 52 (1835). Punjab.

P. porriginosa Tsoong (p. 21). Bhutan.

P. przewalskii Maxim. (p. 6).

P. przewalskii subsp. *australis* (Li) Tsoong (p. 6). S.E. Tibet.

P. pseudoregeliana Tsoong (p. 11). Nepal.

P. punctata Decne in Jacquem., *Voy. Inde,* iv, *Bot.* : 117, t. 122 (1844). Kashmir.

P. pycnantha Boiss., *Diagn. I.* xii : 45 (1853).

P. pycnantha var. *pycnantha*. Kashmir.

P. pycnantha var. *semenovii* (Regel) Prain in *Journ. As. Soc. Bengal* lviii, 2 : 264 (1889). Kashmir.

P. pyramidata Royle (p. 22).

P. pyramidata subsp. *multiflora* (Pennell) Tsoong (p. 22). Kashmir.

P. regeliana Prain in *Journ. As. Soc. Bengal,* lviii, 2 : 273 (1889). Nepal; Bhutan.

P. reptans Tsoong (p. 15). S.E. Tibet.

P. retingensis Tsoong (p. 26). S.E. Tibet.

P. rhinanthoides Schrenk ex Fisch. & Mey., *Enum. Pl. Nov. Schrenk* : 22 (1841).

P. rhinanthoides subsp. *rhinanthoides*. Chinese Turkistan; Punjab; Kashmir.

P. rhinanthoides subsp. *labellata* (Jacquem.) Pennell, *Scroph. W. Himal* : 152 (1943). Kashmir; S.E. Tibet.

P. rhinanthoides subsp. *revoluta* Pennell, *Scroph.* W. *Himal* : 153 (1943). S.E. Tibet.

P. rhizomatosa Tsoong (p. 9). S.E. Tibet.

P. rhynchotricha Tsoong (p. 21). S.E. Tibet.

P. robusta Hook. f., *Fl. Brit. Ind.* iv : 306 (1884). S.E. Tibet.

P. roylei Maxim. (p. 29).

P. roylei var. *roylei*. Kashmir; Punjab; Nepal; Bhutan; S.E. Tibet.
P. roylei var. *brevigaleata* Tsoong (p. 29). Bhutan; S.E. Tibet.
P. schizorhyncha Prain in *Journ. As. Soc. Bengal*, lviii, 2 : 258 (1889). Bhutan; S.E. Tibet.
P. sculleyana Prain apud Maxim. in *Mél. Biol. Acad. Sci. St. Pétersb.* xii : 789, t. 6 (1889). Nepal.
P. shawii Tsoong (p. 29). S.E. Tibet.
P. sherriffii Tsoong (p. 12). S.E. Tibet.
P. siamensis Tsoong (p. 28, footnote,). Siam.
P. sikkimensis Bonati apud W. W. Smith in *Rec. Bot. Survey. Ind.* iv : 401 (1913). S.E. Tibet.
P. siphonantha D. Don (p. 7). Nepal; Bhutan; S.E. Tibet.
P. siphonantha subsp. *prostrata* (Bonati) Tsoong (p. 7). Bhutan.
P. sphaerantha Tsoong (p. 16). S.E. Tibet.
P. stenotheca Tsoong (p. 30). S.E. Tibet.
P. stewartii Pennell, *Scroph. W. Himal* : 135, t. 22 (1943). Kashmir.
P. subulatidens Tsoong (p. 20). S.E. Tibet.
P. szetschuanica Maxim. (p. 30).
P. szetschuanica subsp. *angustifolia* (Bonati) Tsoong (p. 30). S.E. Tibet.
P. takpoensis Tsoong (p. 5). S.E. Tibet.
P. tantalorrhynchoides Tsoong (p. 11). S.E. Tibet.
P. tatsiensis Franch. in Morot, *Journ. Bot.* v : 108 (1891). S.E. Tibet.
P. taylorii Tsoong (p. 11). S.E. Tibet.
P. tenuirostris Benth., *Scroph. Ind.* : 52 (1835). Kashmir.
P. trichoglossa Hook. f., *Fl. Brit. Ind.* iv : 310 (1885). Nepal : Bhutan; S.E. Tibet.
P. umbelliformis Li in *Proc. Acad. Nat. Sci. Philad.* ci : 100, t. 9, f. 157 (1949). S.E. Tibet.
P. wallichii Bunge ex Walpers, *Repert. Bot. Syst.* iii : 415 (1844). Nepal; Bhutan.
P. xylopoda Tsoong (p. 18). Bhutan.
P. sp. near *P. aloensis* Hand-Mazz. Bhutan.

BRITISH MUSEUM NATURAL HISTORY
PRESENTED
14 NOV 1955

NATURAL HISTORY
13 DEC 1955

MOSSES OF DOMINICA, BRITISH WEST INDIES

AND

MOSSES OF THE ECUADORIAN ANDES COLLECTED BY P. R. BELL

EDWIN B. BARTRAM

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 2
LONDON: 1955

MOSSES OF DOMINICA, BRITISH WEST INDIES

AND

MOSSES OF THE ECUADORIAN ANDES COLLECTED BY P. R. BELL

EDWIN B. BARTRAM

Pp. 35–64

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 2
LONDON: 1955

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

Parts will appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, *No.* 2 *of the Botanical series.*

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued December, 1955 *Price Six Shillings*

MOSSES OF DOMINICA, BRITISH WEST INDIES

By EDWIN B. BARTRAM

SITUATED between Martinique and Guadeloupe in the Lesser Antilles, Dominica naturally reflects to a great extent the well known moss flora of these islands. Apart from sporadic records based on random collections, as far as I know no report of the Dominican mosses has ever been published and the extensive collection made by W. R. Elliott between 1892 and 1896 comprising about 800 numbers distributed among 155 species and 68 genera and preserved in the British Museum (Natural History) represents a substantial addition to our knowledge of the Caribbean moss flora. The absence of some typical tropical American species of wide distribution such as *Papillaria nigrescens* (Sw.) Jaeg. suggests that further exploration may expand the list to some extent but the following outline probably represents 90% or more of the actual moss flora.

I am indebted to the Keeper of Botany for the privilege of studying this collection with all the valuable notes and drawings made by Mr. A. Gepp over half a century ago in a preliminary study which have been of substantial help in the identification of the species involved. A representative duplicate series of the specimens cited is in my herbarium.

To avoid repetition, some of the principal localities visited by Elliott are referred to in the list by the symbols given below.

A—Morne Anglais; B—Morne Couliston; C—Morne Couronne; D—Morne Diablotin; M—Morne Micotrin; P—Picard Valley; R—Roseau Valley; S—Grand Souffriere; T—Morne Trois Pitons.

FISSIDENTACEAE

FISSIDENS MOLLIS Mitt.

P, on rocks; *928, 996a*. R, roadside bank; *467a*.

FISSIDENS KEGELIANUS C. Muell.

R; *467, 713*

Fissidens (Sect. ***Bryoidium***) **pseudorepandus** E. B. Bartr., sp. nov.

Dioicus? tenellus gregarie crecens, pallide viridis. *Caulis* erectus, simplex, fertilis 3 mm., sterilis ad 5–7 mm. altus; *folia plantae sterilis* 10–14 juga, erecto-patentia, oblongo-lanceolata, acuminata, c. 2 mm. longa, vix 0·4 mm. lata, limbata, limbo hyalino infra summum apicem evanido, lamina vera ultra medium follii producta, lamina dorsali ad basin nervi enata, ibidemque rotundata; costa cum apice evanida; *cellulis* minutissimis, diam. c. 5μ, opacis, minute papillosis; *folia plantae fertilis* 6 juga, infima minuta, superiora multo majora, ad 2 mm. longa, anguste acuminata; *seta* vix 3 mm. alta, tenuissima, rubra; *theca* inclinata, ovalis, minuta.

Morne Trois Pitons, 15 November, 1892, without number (holotype in Herb. Brit. Mus.).

Near *F. repandus* Wils., but leaf cells smaller, densely and minutely papillose and the dorsal lamina ending in a rounded lobe at the insertion.

FISSIDENS ELEGANS Brid.
T, 1,100 m ; *755.* Giraudel, on fallen tree, 600 m.; *2338a.*

FISSIDENS LEPTOPODUS Cardot.
Four collections at moderate altitudes.

FISSIDENS PELLUCIDUS Hornsch.
Four collections at moderate altitudes.

? FISSIDENS RADICANS Mont.
R, on wall ; sterile specimen ; *712*

FISSIDENS MURICULATUS Spruce.
P, on twigs ; *963B.* D, windward slope, 600–900 m.; *2129*

FISSIDENS SIMILIRETIS *var.* GUADALUPENSIS (Schimp.) Grout.
Eleven collections all of which seem to be referable to the variety rather than to the typical form.

FISSIDENS POLYPODIOIDES Hedw.
Eleven collections indicate a general distribution over the island.

DICRANACEAE

TREMATODON TENELLUS Schimp.
Bute Estate, on rocks ; *472b.*

DICRANELLA HERMINIERI Besch.
R, on bank, 600 m ; *39.* S, on rocks in crater ; *816.*

DICRANELLA SUBINCLINATA Lorentz.
R, on banks ; *43, 45, 46, 1171a.*

DICRANELLA BRACHYBLEPHARIS (C.Muell.) Mitt.
River Douce Valley, on rocks ; *703.* R, on bank, *985c, 989.*

DICRANELLA PERROTTETII (Mont.) Mitt.
Some fifteen collections mostly from higher altitudes where it is broadly distributed locally.

CAMPYLOPUS SAXATILIS R. S. Williams.
B, with *Leucobryum* on tree ; *1915a*

Campylopus (Sect. ***Eucampylopus***) **elliottii** E. B. Bartr., sp. nov.

Dioicus ; robustiusculus, caespitibus laxiusculis, lutescentibus, inferne fuscescentibus, nitidis. *Caulis* erectus, usque ad 7 cm. altus, irregulariter ramosus ; *folia* late patentia, haud secunda, e basi breviter oblonga sensim piliformiter acuminata, 7–10 mm. longa ; marginibus superne argute serratis ; costa inferne c. 0·7 mm. lata, excurrente, dorso laevi ; *cellulis* laminalibus elongatis, marginalibus majoribus, rhomboideis, basilaribus internis breviter oblongis, laxis, parietibus tenuissimis, externis in seriebus pluribus angustatis, alaribus numerosis, hyalinis vel fuscis, in ventrem dispositis. Caetera ignota.

Summit of Morne Trois Pitons, on trees and rock, 30th July, 1892, *478a* (holotype in Herb. Brit. Mus.).

While similar in some respects to *C. brittonae* R. S. Williams, of Jamaica, *C. elliottii* is sharply distinct in the shorter leaves erect in the comal tuft and especially in the lax, thin walled interior basal cells and the elongate lamina cells.

CAMPYLOPUS PORPHYREODICTYON (C. Muell.) Mitt.
B, on bank; *1915b, 1920*; *878a.*

CAMPYLOPUS ARCTOCARPUS (Hornsch.) Mitt.
D; *691.*

CAMPYLOPUS RICHARDI Brid.
On or near summits of higher peaks; *477, 1106, 2230a, 2255.*

EUCAMPTODONTOPSIS PILIFERA (Mitt.) Broth.
T, on trees and rocks at high altitudes; *483, 2230* form, *2311.*

LEUCOLOMA SERRULATUM Brid.
At least 20 collections showing a broad local distribution.

LEUCOLOMA ALBULUM (Sull.) Jaeg.
R, on rocks at roadside; *1166, 1129a.*

LEUCOLOMA CRUGERIANUM (C. Muell.) Jaeg.
Seven collections from various localities showing a rather general distribution.

LEUCOLOMA MARIEI Besch.
R, on rocks; *14.* T, on trees, 900–1,370 m.; *733a, 2314.*

LEUCOBRYACEAE

OCTOBLEPHARUM ALBIDUM Hedw.
Two collections from low altitudes.

LEUCOBRYUM ANTILLARUM Schimp.
B, on trees; *1915.*

LEUCOBRYUM CRISPUM C. Muell.
D, on trees; *1050a.*

LEUCOBRYUM POLAKOWSKYI (C. Muell.) Cardot.
R, on trees and rocks; *1168*

LEUCOBRYUM MARTIANUM (Hornsch.) Hampe.
Nine collections mostly from low and moderate altitudes.

CALYMPERACEAE

SYRRHOPODON RIGIDUS Hook. & Grev.
Fourteen collections indicating a general distribution.

SYRRHOPODON PROLIFER Schwaegr.
Seven collections mostly from moderate altitudes.

SYRRHOPODON TENUIFOLIUS (Sull.) Mitt.
Rather frequent at medium to high altitudes. Represented by six collections.

SYRRHOPODON HUSNOTI Besch.
More frequent than the preceding in at least ten collections.

SYRRHOPODON LYCOPODIOIDES (Sw.) C. Muell.
On trees and rocks at moderate altitudes. Six collections.

CALYMPERES RICHARDI C. Muell.
Pagona Bay, on tree ; *518*. Shawford Estate, on Lime trees ; *892c*.

CALYMPERES DONNELLII Austin.
Four collections from trees and rocks at low altitudes.

CALYMPERES DISCIFORME C. Muell.
On decaying tree stumps, Luzon Park, alt. 245 m.; *202b*

CALYMPERES GUILDINGII Hook. & Grev.
Frequent and broadly distributed locally. At least 20 collections.

CALYMPERES LONCHOPHYLLUM Schwaegr.
Five collections from various localities indicate a frequent distribution.

POTTIACEAE

ANOECTANGIUM EUCHLORON (Schwaegr.) Mitt.
On banks. Five collections.

RHAMPHIDIUM DICRANOIDES (C. Muell.) E. B. Bartr.
Not uncommon on banks. Five representative collections.

WEISIA JAMAICENSIS (Mitt.) Grout.
Botanic Garden, Roseau, on bank ; *784*.

HYOPHILA TORTULA (Schwaegr.) Hampe.
Not uncommon at low altitudes. Four collections.

BARBULA AGRARIA Hedw.
R, *711a, 714, 782*

BARBULA SUBULIFOLIA Sull.
Four collections one of which *1198*, shows the leaves more bluntly pointed than usual.

SPLACHNOBRYUM OBTUSUM C. Muell.
I have referred eight collections here but the group needs critical study before the names can be applied with any satisfaction.

SPLACHNOBRYUM WRIGHTII C. Muell.
Bath Estate, on rocks ; *472aa*.

SPLACHNOBRYUM JULACEUM Besch.
R, on walls ; *785*. This collection agrees well with the original description but I have not seen the type material.

SPLACHNOBRYUM MARIEI Besch.

Emsol Estate, on bank at roadside; *467a.* The ovate leaves with plane margins and the peristome teeth projecting beyond the mouth of the capsule suggest that this may be the same plant described from Guadeloupe.

BRYACEAE

Anomobryum antillarum E. B. Bartr., sp. nov.

Gracillimum, caespitosum, caespitibus densis lutescenti-viridibus. *Caulis* erectus, ad 1 cm. altus, simplex, inferne fusco- radiculosus. *Folia* sicca et humida imbricata, minuta, c. 0·45 mm. longa, concava, acuta; marginibus erectis, integerrimis; costa infra apicem folii evanida: *cellulis* rhombeis teneris, superne c. 70μ longis, 10μ latis, infimis laxioribus, breviter rectangularibus. *Seta* 7–8 mm. longa; *theca* inclinata, ovalis, brevicollis, deoperculata 1·2 mm. longa; *exostomii* dentes lanceolati, ad 225μ longi, lutescentes, endostomium imperfectum, corona basilaris circa $\frac{1}{2}$ dentium longitudinis, processus dentium longitudinis, carinati, rimosi, cilia valde rudimentaria, brevissima, solitaria vel nulla; operculum conicum; spori c. 15μ.

On bank at Emsol Estate, Roseau, 4th August, 1892; *470* (holotype in Herb., Brit. Mus.).

The imperfect inner peristome with the cilia lacking or very rudimentary will distinguish this species from *A. leptocladon* (Sull.) Broth. to which it bears a superficial resemblance.

BRYUM CRUGERI Hampe.

A widely distributed tropical American species represented locally by three collections.

BRYUM RUBRIFOLIUM Schimp.

A sterile collection in poor condition seems to belong here.

RHIZOGONIACEAE

RHIZOGONIUM SPINIFORME (Hedw.) Bruch.

Four collections several of which are rather more robust than usual.

BARTRAMIACEAE

PHILONOTIS GLAUCESCENS (Hornsch.) Paris.

Frequent and variable. Represented by more than twenty collections.

PHILONOTIS GRACILLIMA Angstr.

Bath Estate, on rocks; *472a1.* A fragmentary specimen referred here as the leaves show the characteristically rounded apex. Separated from a mixed gathering of *Sematophyllum caespitosum* (*472*) and *Philonotis glaucescens* (*472a*).

PHILONOTIS SPHAERICARPA (Hedw.) Brid.

Repesented by sterile collections. M, growing on rocks near summit; *1100.* On a bank at Belle Vue; *1294.*

PHILONOTIS UNCINATA (Schwaegr.) Brid.

Infrequent locally. On a bank, The Lake, Roseau Valley; *48.* S, in crater; *844, 1844.*

BREUTELIA SCOPARIA (Schwaegr.) Schimp.
M, on trees, 900 m.; *25*. R, among grass near Roseau Lake, 820 m.; *1175*.

Breutelia (Sect. *Acoleos*) **dominicensis** E. B. Bartr., sp. nov.

Robustiuscula, caespitosa caespitibus laxis, lutescenti-viridis, intus fuscescentibus, nitidiusculis. *Caulis* ad 20 cm. longus, parce ramosus. *Folia* dense conferta, horride patentia, valde deflexa, c. 5 mm. longa, e basi breviter ovali sensim lanceolata, plicata, aristata ; marginibus anguste revolutis, superne denticulatis ; costa tenuis, in aristam denticulatam excedente ; *cellulis* anguste linearibus, papillosis, alaribus laxis, rectangularibus, pellucidis, in seriebus marginalibus 4–7 satis alti productis. Caetera ignota.

Morne Micotrin, on rocks and trees near summit, 900–1150 m.; *1095a*, *1107* (holotype in Herb. Brit. Mus.), *1112a* ; Morne Trois Pitons, summit on trees and rocks ; *478* ; Morne Trois Pitons, summit of central peak, 1420 m. ; *2231b*.

The lax, oblong cells in 4–7 rows at the basal leaf angles extending well up the margins preclude any comparison with *B. scoparia* (Schwaegr.) Schimp. or *B. hispida* Mitt. as both of these species show the alar cells small and subquadrate. This feature is also distinctive in comparison with *B. tomentosa* (Sw.) Schimp. where the differentiated alar cells are few and typically in one row at the extreme base. I have a specimen labelled *B. scoparia* by Bescherelle collected in Guadeloupe (Sources du Galion, a la Citerne) by Duss, No. *405*, which agrees perfectly with the above collections from Dominica. Until fruit is available no further comparisons can be made.

ORTHOTRICHACEAE

MACROMITRIUM CIRROSUM (Hedw.) Brid.
Eight collections indicating a general distribution.

MACROMITRIUM SCOPARIUM Mitt.
Frequent at high altitutes. Six collections.

MACROMITRIUM PERICHAETIALE (Hook. & Grev.) C. Muell.
On trees and rocks at higher altitudes. Seven collections.

MACROMITRIUM DUBIUM Schimp.
On trees on or near summits of higher peaks. Five collections.

GROUTIELLA APICULATA (Hook.) Crum & Steere.
R, on rocks and trees ; *16*. M, on rocks, 1,100 m. *1131*.

GROUTIELLA MUCRONIFOLIA (Hook. & Grev.) Crum & Steere.
On bank and trees, Belle Vue Road ; *1325a*.

GROUTIELLA HUSNOTII (Schimp.) Crum & Steere.
On rocks, River Douce Valley ; *706*.

HEDWIGIACEAE

RHACOCARPUS HUMBOLDTII (Hook.) Lindb.
From the higher peaks ; *479*, *2229*.

PTEROBRYACEAE

ORTHOSTICHOPSIS AURICOSTA (C. Muell.) Broth.
M, on trees, 610–1,220 m.; *57*

These plants along with others in the herbarium from Guadeloupe, St. Vincent, Trinidad, Colombia and Peru seem to agree with the description of *O. auricosta* (*Meteorium auricosta* C. Muell. in *Flora* lxxxiii : 339 (1897)). The branch leaves are usually short apiculate, but are variable and occasionally piliform acuminate. The more robust habit and the branch leaves spirally ranked will separate it from *O. crinita* (Sull.) Broth. and the smooth, non plicate leaves from *O. tetragona* (Sw.) Broth.

PTEROBRYUM ANGUSTIFOLIUM (C. Muell.) Mitt.
C, 305–610 m ; *208, 208a.*

PIREELLA CAVIFOLIA (Cardot & Herzog) Cardot.
D, on trees, 1,220–1,455 m.; *654.*

METEORIACEAE

SQUAMIDIUM NIGRICANS (Hook.) Broth.
C, on trees, 305–610 m.; 207.

SQUAMIDIUM LEUCOTRICHUM (Tayl.) Broth.
Frequent on trees at moderate altitudes ; *201, 210d, 719, 1077c, 2223c.*

PILOTRICHELLA HEXASTICHA (Schwaegr.) Jaeg.
Three collections from the higher peaks ; *639, 1006, 1075b.*

PILOTRICHELLA FLEXILIS (Hedw.) Jaeg.
On trees at moderate altitudes ; *669b, 1018d.1.*

PAPILLARIA DEPPEI (Hornsch.) Jaeg.
D, hanging from trees, 1,220–1,370 m.; *1007, 1018d, 1022d.*

METEORIOPSIS REMOTIFOLIA (Hornsch.) Broth.
On trees and foliage in at least eleven collections showing a general distribution.

PHYLLOGONIACEAE

PHYLLOGONIUM FULGENS (Hedw.) Brid.
Hanging from trees mostly at high altitudes. Eight collections.

NECKERACEAE

NECKEROPSIS UNDULATA (Hedw.) Reichardt.
C, on trees 305–610 m.; *214.* P, on tree ; *971c.* Belle Vue, on lianas ; *1324.*

NECKEROPSIS DISTICHA (Hedw.) Fleisch.
C, on tree trunks, 305–610 m.; *214a.* On rocks at Emsol, Roseau ; *993.*

HOMALIA GLABELLA (Hedw.) Mitt.
D, 1,220–1,430 m. on trees ; *653.* Giraudel, on trees ; *2339.*

PINNATELLA PINNIFORMIS (Brid.) Fleisch.
The collections indicate a generous local distribution ; *210, 2196, 1018b, 1072c, 1604.*

Porotrichum insularum Mitt.

Frequent on trees at moderate to high altitudes. Fourteen collections.

PILOTRICHACEAE

Pilotrichum compositum (Sw.) Beauv.

D, on trees, 610–1,220 m.; *1015, 1066.* M, on trees, 900–1,065 m.; *1125.* Head of Castle Bruce River, on trees; *1618.*

Pilotrichum hahnianum Besch.

R, 305–610 m.; *34.* M, on trees 600–1,220 m.; *35.* P, on trees and rocks; *958.*

Pilotrichum herminieri Schimp.

D, on trees, 760–1,370 m.; *1007c, 2180b.* R, on trees, 820 m.; *1174b.*

Pilotrichum husnotii Schimp.

Mostly from the higher peaks at altitudes above 910 m.; *33, 35a, 727a, 729, 1022, 1091, 1802, 2225b.*

Pilotrichidium antillarum Besch.

Widely distributed locally in seventeen collections mostly from the slopes of the higher peaks.

HOOKERIACEAE

Daltonia stenophylla Mitt.

On the roof of the Boathouse, The Lake, Roseau, *2, 2c.1.*

Leskeodon

This highly interesting and instructive series, comprising 38 collections, throws considerable light upon the West Indian species of a very attractive genus which seems to have its headquarters if not its centre of distribution in the Caribbean region. The following tentative key may assist in locating the species in this rather complex group some of which may have to be reduced to synonymy upon more critical study. The distinctions between *L. pusillus* and *L. parvulus* and between *L. longipilus* and *L. cubensis* are especially worthy of more detailed comparisons.

Key to the Species

1.	Upper leaf cells 2–3 times longer than wide, seta 1 cm. long	*mariei*
	Upper leaf cells isodiametrical, seta 2·5–6 mm. long	2
2.	Upper leaf cells small, 10–14μ, leaves short pointed	3
	Upper leaf cells larger, 18–24μ, leaves piliform acuminate	7
3.	Leaves broadly rounded, minutely mucronate, border weak, 1–2 cells wide above	*andicola*
	Leaves apiculate, border strong, 2–3 cells wide above	4
4.	Dioicous, golden green plants	5
	Autoicous, green or yellowish green plants	6
5.	Upper leaf cells 10μ in diam. border strong, 3–4 cells wide above	*auratus*
	Upper leaf cells 12–15μ in diam., border 2 cells wide above	*dussii*
6.	Leaf border strong, 3 rows wide above, leaves spatulate, apiculate	*pusillus*
	Leaf border narrower, 1–2 rows wide above, leaves oblong-lanceolate, acuminate	*parvulus*
7.	Leaves acuminate, apiculus *c.* 150μ long, upper cells rounded, not collenchymatous, diam. 16–22μ	*cubensis*
	Leaves hair-pointed, apiculus 300–600μ long, upper cells collenchymatous with angular lumen, diam. 20–30μ	*longipilus*

LESKEODON MARIEI (Besch.) Broth.

M, on rocks at summit, 1,150 m.; *1092.* T, on rock, summit of the Centre Peak; *2243.* T, on trees, North Peak; *2259.* T, on rocks, summit of Middle Peak; *2288, 2289.*

LESKEODON AURATUS (C. Muell.) Broth.

T, 1,100 m.; *748a.* On trees, Basin Wall; *504.*

Leskeodon dussii (Besch.) E. B. Bartr., comb. nov.

Distichophyllum dussii Besch. in Journ. de Bot. xvi; 8 (1902).

A, on branches of trees, 900–1,060 m.; *488.*

LESKEODON ANDICOLA (Spruce) Broth.

T, on twigs at camp, 760 m.; *753a.1.* T, 1,100 m.; without number.

LESKEODON PUSILLUS (Mitt.) Broth.

D, on trees, 760–1,430 m.; *687, 2124a.* T, on trees and twigs at Camp, 760 m.; *753d.*

LESKEODON PARVULUS (Schimp.) Broth.

T, on trees, twigs and rocks, 760–1370 m.; *746, 753a, 753c, 2287, 2314d.* On trees, head of Castle Bruce River; *1687.* On twigs, Hampstead Valley; *1333, 1986.* P, on trees; *944.*

Leskeodon cubensis (Mitt.) E. B. Bartr., comb. nov.

Distichophyllum cubense Mitt. in Journ. Linn. Soc. Bot. xii: 395 (1869).

On stem of tree fern, Morne Micotrin, 900–1,220 m.; *7.* T, on trees and twigs, 760–1220 m.; *481b, 753b.*

Leskeodon longipilus (Besch.) E. B. Bartr., comb. nov.

Distichophyllum longipilum Besch. in Journ. de Bot. xvi: 8 (1902).

A, 900–1,060 m.; *488a.* D, windward slope, *2210a.* D, on trees 1,220–1,430 m.; *690b.* M, on trees 610–1,220 m.; *69b, 1108a.* T, on trees and rocks, 900–1370 m.; *2294* robust form, *2251* robust form, *2271, 2239b, 1751, 753d.* R, on trees; *28a, 1199.* Pegona Hills, on bank, 460 m.; *2185.*

HOOKERIA ACUTIFOLIA Hook.

Near Lake, Roseau Valley, 600–760 m.; *83.* D, windward slope, 760–900 m.; *2104a.* T, 1,420 m., on rocks; *2277.*

CYCLODICTYON ALBICANS (Hedw.) Broth.

On wet rocks and trees from medium to high altitudes; *108, 663, 928d, 953g, 2200b, 2201b, 2324.*

All of these collections show the leaves more or less serrulate above and the upper cells isodiametrical. They seem to me to be habitat forms of one species which possibly includes *Hookeria albicaulis* Schimp.

CALLICOSTELLA HERMINIERI (Schimp.) Jaeg.

Represented by eight collections well distributed.

CALLICOSTELLA FILESCENS (Schimp.) Broth.
T, on twigs, 1,100 m.; *747*. S, on ground; *867*.

CALLICOSTELLA DEPRESSA (Sw.) Jaeg.
Hampstead Valley, on bark; *1983a*. D, on trees; *650* (identification doubtful; sterile specimen), *2207*.

CALLICOSTELLA SUBFISSIDENTOIDES (Schimp.) Broth.
P, on banks and decaying bark; *950, 954a, 961b*. D, on rocks, windward slope, 760–900 m.; *2179a*. On rocks, Bruce Castle; *1721*.

CALLICOSTELLA BELANGERIANA (Besch.) Jaeg.
Five collections with a broad distribution; *41, 1990a, 2140b, 2323e 2338b*.

CALLICOSTELLA LONGIPEDUNCULATA (C. Muell.) Jaeg.
T, on trees, 900–1,370 m.; *776*.

HOOKERIOPSIS GUADALUPENSIS (Brid.) Jaeg.
Twenty or more collections well distributed on trees, rocks and decaying wood throughout the island.

HOOKERIOPSIS FALCATA (Hook.) Jaeg.
Frequent in ten collections with a broad distribution.

HOOKERIOPSIS FALCATULA (Schimp.) Jaeg.
M, on trees, 600–900 m.; *1086a*. Very doubtfully distinct from the preceding.

HOOKERIOPSIS LEIOPHYLLA (Besch.) Jaeg.
Nine collections showing a fairly general distribution.

HOOKERIOPSIS ACICULARIS (Mitt.) Jaeg.
T, on rocks, 600–900 m.; 475. Luzon Flats, on trees, 245 m.; *2102*.

LEPIDOPILUM ANTILLARUM Mitt.
R, on trees and rocks; *8d, 30*.

LEPIDOPILUM MULLERI (Hampe) Mitt.
M, on trees, 600–1,220 m.; *29a*. D, windward slope 900 m.; *2224a.1*.

LEPIDOPILUM RADICALE Mitt.
Ten collections well distributed as to localities and often fruited.

LEPIDOPILUM PURPURASCENS Schimp.
Twelve collections showing a general distribution but uniformly sterile.

LEPIDOPILUM PORTORICENSE (C, Muell.) Broth.
C, on trees, 305–610 m.; 206a. T, on trees, 1370 m.; *2322*. D, on trees 1065 m.; *1068*.

LEPIDOPILUM INTEGRIFOLIUM Broth.
Laudat, on a stump of a tree, 515 m.; *480*.

Lepidopilum (Sect. ***Eulepidopilum***) **dominicense** E. B. Bartr., sp. nov.

Gracile, pallide viride, laxe caespitosum, nitidum. *Caulis* ad 6–7 cm. longus, laxe foliosus, valde complanatus, simplex, flexuosus, cum foliis 4 mm. latus haud radiculosus. *Folia* lateralia late patentia, ovata, elimbata, angulo acuto terminata,

c. 2 mm. longa, 1 mm. lata ; marginibus planis, integerrimis ; costa nulla ; *cellulis* haud incrassatis, elongatis, teneris, c. 135μ longis, 12–15μ latis. Caetera ignota.

Morne Micotrin, on trees, 945 m., *1231a* (holotype in Herb. Brit. Mus.).

In the absence of fruit this species cannot be definitely located, but the entire ecostate leaves with long, sharply pointed cells suggest no other tropical American species with which I am familiar.

Lepidopilum polytrichoides (Hedw.) Brid.

C, on trees, 305–610 m.; *200*. D, windward slope, 760–900 m.; *2206c*. P, on trees ; *945a*, Larier Claire River, on trees ; *2342*.

Isodrepanium lentulum (Wils.) E. G. Britton.

Hanging from branches of trees at moderate to high altitudes. Ten collections.

Crossomitrium subepiphyllum (Besch.) Jaeg.

About fifteen collections mostly on foliage.

Crossomitrium herminieri (Schimp.) Jaeg.

Less common than the preceding and usually growing on twigs or bark. Five collections.

Hypnella filiformis (Hook.) Jaeg.

Frequent and broadly distributed. Represented by about 20 collections.

Hypnella leptorrhyncha (Hook. & Grev.) Jaeg.

Less frequent than *H. filiformis*, but not uncommon. Six representative collections.

Hypnella cymbifolia (Hampe) Jaeg.

P, on decaying trees ; *973a*. Pagona Hills, on fallen trees, 760 m.; *515*. Luzon Flats, on rocks and rotten wood ; *2220, 2139a*.

Rhynchostegiopsis flexuosa (Sull.) C. Muell.

Not uncommon on trees, six collections.

Harpophyllum aureum (Beauv.) Spruce.

Frequent on trees and rocks. At least ten representative collections.

LEUCOMIACEAE

Leucomium attenuatum Mitt.

On trees and decayed wood, frequent and broadly distributed. Ten collections.

Leucomium compressum Mitt.

D, windward slope, on fallen trees, 760–900 m.; 1996a.

Leucomium robustum E. B. Bartr., sp. nov.

Synoicum, robustum, lutescenti-viride, nitidiusculum. *Caulis* prostratus, vage ramosus, complanatus, cum foliis 4 mm. latus. *Folia* lateralia 2·5–3 mm. longa, ovato-lanceolata, sensim piliformiter acuminata, caviuscula, ecostata, integerrima ; *cellulis* perlaxis, elongati-hexagonis, c. 130μ longis, 20μ latis. *Seta* 1·5–2 cm. longa, laevissima ; *theca* horizontalis, deoperculata 1·5 mm. longa ; operculum conico-rostratum, intense rubrum, 1·5 mm. longum.

Morne Diablotin, windward slope, 760–900 m., *2204* (holotype in Herb. Brit. Mus.).

More robust than *L. compressum* Mitt. with longer, more slenderly acuminate leaves and longer setae.

HYPOPTERYGIACEAE

HYPOPTERYGIUM TAMARISCINUM (Hedw.) Brid.

A, 1,100 m.; *489*. D, on trees and ground, 1,220–1,430 m ; *662*.

LESKEACEAE

THUIDIUM ANTILLARUM Besch.

Nine collections showing a general distribution.

BRACHYTHECIACEAE

LEPYRODONTOPSIS TRICHOPHYLLA (Sw.) Broth.

Ten collections broadly distributed.

PLAGIOTHECIACEAE

STEREOPHYLLUM CULTELLIFORME (Sull.) Mitt.

Bath Estate, on rocks ; *472c*.

SEMATOPHYLLACEAE

PTEROGONIDIUM PULCHELLUM (Hook.) C. Muell.

On trees at low elevations ; *700* (in part), *702a, 1243a*.

MEIOTHECIUM BORYANUM (Mont.) Mitt.

Douce Valley, on Orange trees ; *722*. Shawford Estate, on Lime trees ; *892*.

SEMATOPHYLLUM SUBSIMPLEX (Hedw.) Mitt.

C, on tree trunks at low altitudes ; *227b*. T, on rocks, 1,220–1,400 m.; *2302a*. Hampstead Valley, on trees ; *1332*.

SEMATOPHYLLUM CAESPITOSUM (Hedw.) Mitt.

Twenty two collections showing a broad distribution of this protean species.

SEMATOPHYLLUM ADNATUM (Michx.) E. G. Britton.

R, Emsol, on rock ; *992, 1788*. Luzon Park, on decayed tree, 240 m.; *235a*.

RHAPHIDOSTICHUM SCHWANECKIANUM (C. Muell.) Broth.

R, on trees, 305–610 m.; *28*. M, on trees, 610–1,065 m.; *1087c*. T, on trees ; *2311b*.

ACROPORIUM PUNGENS (Hedw.) Broth.

Very common in about 25 collections and broadly distributed.

TRICHOSTELEUM VINCENTIUM (Mitt.) Jaeg.

Frequent in about 10 collections with a general distribution.

TRICHOSTELEUM PTEROCLADIUM (Besch.) Jaeg.

P, on trees ; *930*. D, on fallen trees, windward slope, 760–910 m.; *1996*.

TRICHOSTELEUM BRACHYDICTYON (Besch.) Jaeg.

P, on bark of trees ; *955*. D, on trees, windward slope, 760–910 m.; *1994, 1994a*. T, on Palm stems, 1,400 m. *2278a*.

TAXITHELIUM PLANUM (Brid.) Mitt.

Very common and broadly distributed in about 20 collections.

TAXITHELIUM PORTORICENSE R. S. Williams.
P, on decaying bark; *961c.*

Glossadelphus laevifolius (Mitt.) E. B. Bartr., comb. nov.

Ectropothecium laevifolium Mitt. in Journ. Linn. Soc. Bot. xii : 517 (1869).
Hookeriopsis cocoensis R. S. Williams, Bryol. 27 : 40 (1924).
Glossadelphus longisetus E. B. Bartr., Contrib. U.S. Nat. Herb. xxvi, 3 : 109 (1928).

The clue to this discovery was afforded by a notation of Mr. Gepp's that the Dominican plants were an exact match for *Ectropothecium laevifolium* Mitt. Through the kindness of Dr. D. P. Rogers I have been able to confirm this observation by a comparison with the type material from the Mitten Herbarium. All of the collections from the Galapagos Islands, Costa Rica and Guatemala show considerable variation in the leaf apices from rounded to subacute but apart from this they clearly represent one specific type.

T, on trees, near Camp, 760 m.; *754.*

HYPNACEAE

ECTROPOTHECIUM APICULATUM (Hornsch.) Mitt.
D, windward slope, 900 m., on bark; *2175a.* M, 900–1,065 m., on rocks; *1129.* Laudat, 515 m.; *506a.* Castle Bruce River, on rocks; *1654b, 1720.*

ISOPTERYGIUM TENERUM (Sw.) Mitt.
Not uncommon in five collections.

ISOPTERYGIUM HERMINIERI Schimp.
R, on rocks, 305–610 m.; *54a.*

ISOPTERYGIUM MICANS (Sw.) Broth.
R, on rocks and trees; *5a, 6g.*

ISOPTERYGIUM LONGISETUM (Schimp.) Broth.
879, 1607, 1841, 1843.

VESICULARIA VESICULARIS (Schwaegr.) Broth.
Five collections.

VESICULARIA VESICULARIS var. POEPPIGIANA (Hampe.) Broth.
R, 300–600 m., on rocks; *53a.* T, 900–1,220 m., on rocks; *777.*

VESICULARIA AMPHIBOLA (Spruce) Broth.
R, on dry stone and damp walls; *711, 715.* Belle Vue Road, among Palm and Fern roots; *1295.* Larier Claire River, on trees; *2342c.*

MITTENOTHAMNIUM REPTANS (Hedw.) Cardot.
Not uncommon in seven collections.

POLYTRICHACEAE

POGONATUM TORTILE Beauv.
Near Laudat, 450 m.; *18.* M, 600–1,200 m., on trees; *57c.* Road to Roseau Lake, 515–820 m.; *1216.*

MOSSES OF THE ECUADORIAN ANDES

COLLECTED BY P. R. BELL

By EDWIN B. BARTRAM

A COLLECTION of mosses comprising about 450 numbers made by Dr. Peter H. Bell in the classical Andean region of Ecuador in March and April, 1951, has been entrusted to me for determination by the Keeper of Botany, the British Museum (Natural History). As the area covered includes the upper slopes and summit of Mt. Pichincha and the slopes of Mt. Tungurahua many of the species collected by Richard Spruce and William Jameson about a century ago are duplicated, but the occurrence of seven apparently undescribed items together with a number of previously unrecorded species accentuates the need for further exploration before a really comprehensive idea of the moss flora of this fertile region can be arrived at.

To avoid repetition the principal localities visited by Dr. Bell are listed below with an accompanying symbol which is used in the detailed list of species.

A complete series of Dr. Bell's collections is deposited in the herbarium of the British Museum (Natural History) and a representative selection is in the author's herbarium.

A—Pichincha ; B—Above Chaupi-Sagcha, Pululagua ; C—San Juan, Quito ; D—By Rio Toachi above confluence with Pilaton ; E—Between Banos and Rio Verde ; F—Near Hacienda Pululagua ; G—Near Hacienda Monjas, Concepcion, Pichincha ; H—N.W. slopes of Tungurahua ; J—Chiriboga, 50 km. W. of Quito ; K—Near San Jose de Toachi, 100 km. W. of Quito ; L—Paramo above Pujuli ; M—Potrerillo, Pululagua ; N—Campamento Guilo, Pilalo ; P—Above Salvador.

ANDREACEAE

ANDREAEA BREVIPES Spruce.

A, rocks near summit, 4,420–4,572 m.; *380, 394, 394a, 401, 406a, 412a.*

ANDREAEA VULCANICA Lorentz.

A, rocks at summit, 4,572 m.; 416.

FISSIDENTACEAE

FISSIDENS REPANDUS Wils.

G, 3,109–3,353 m.; *36a, 37a, 39a, 41, 42b, 43a, 56, 58a, 62a, 66a, 70, 423.* B, *599a, 600, 611a, 622, 649b.* C, *316a.* A, *131a, 134a.*

FISSIDENS ELEGANS Brid.

A, *377a.*

FISSIDENS ASPLENIOIDES Hedw.

B, *593.* M, *652, 652a.* J, *307a.*

DITRICHACEAE

CERATODON PURPUREUS (Hedw.) Brid.
A, 3,658 m.; *152.*

DITRICHUM GRACILE Mitt.
A, 3,963–4,572 m.; *106* in part, *151, 417, 414* in part.

DICRANACEAE

TREMATODON HUMILIS Mitt.
B, 1,981 m., on damp bank ; *641.*

ANISOTHECIUM CAMPYLOPHYLLUM (Tayl.) Mitt.
A, 3,963 m.; *119* in part, *158, 164.* C, 3,505 m. Paramo ; *723.*

ANISOTHECIUM JAMESONI (Tayl.) Mitt.
C, roadside bank ; *313, 313a.*

AONGSTROEMIA JULACEA (Hook.) Mitt.
A, 4,115 m.; *106* in part, *106a* in part.

Microdus rubrisetus E. B. Bartr., sp. nov.

Dioicus, pusillus, caespitosus, caespitibus densis, lutescenti-viridibus. *Caulis* 2–3 mm. altus ; *folia* erecto-patentia, 1–1·5 mm. longa, anguste triangulari-lanceolata ; marginibus erectis, summo apice minute denticulatis ; costa infra summum apicem evanida ; *cellulis* anguste rectangularibus, ad 50μ longis, 4–5μ latis, basilaribus laxioribus. *Seta* 5–6 mm. longa, rubra ; *theca* parva, inclinata, asymmetrica, curvata, deoperculata 0·5 mm. longa ; operculum breviter rostratum ; annulus nullus ; dentes peristomii c. 250μ longi, papillosi, haud striolati, ultra medium in crura bina divisi.

Chaupi-Sagcha, Pululagua, on soil on rock, *c.* 1,829 m., 15th April, 1951, *582* (holotype in Herb. Brit. Mus.).

Suggestive of *Dicranella varia* (Hedw.) Schimp., but distinct in the shorter papillose peristome teeth, not longitudinally striolate.

DICRANELLA HILARIANA (Mont.) Mitt.
B, 1,981 m., on calcareous rock by stream ; *635.*

CAMPYLOPUS LEUCOGNODES (C. Muell.) Paris.
A, on soil in crevice of rock near summit, 4,572 m. ; *411.*

CAMPYLOPUS CAVIFOLIUS Mitt.
A, 3,963–4,572 m.; *114, 170, 367, 369a, 414.* C, Paramo, 3,505 m.; *721c.*

CAMPYLOPUS INTROFLEXUS (Hedw.) Brid.
B, 1,829 m.; *592.* D, 914 m.; *324, 324a,* E, 1,676 m.; *886.*

Campylopus (Sect. ***Eucampylopus***) **capitulatus** E. B. Bartr., sp. nov.

Sat robustus, caespitosus, lutescentibus, nitidiusculus ; *caulis* erectus, usque ad 3·5 cm. altus, inferne pallide tomentosus, parce ramosus, densissime capitulatus ; *folia caulina* erecto-patentia, 5–5·5 mm. longa, e basi oblonga sensim longe subulata ; marginibus superne serrulatis ; costa ad basin *c.* 0·3 mm. lata, dorso superne humiliter lamellata, breviter excurrente ; *cellulis* superioribus rhombeis, basilaribus

internis breviter rectangularibus, hyalinis, externis in seriebus 5–6 anguste linearibus, alaribus nullis. Caetera ignota.

Chaupi-Sagcha, Pululagua, on a stump, *c.* 1829 m., 15th April, 1951, *591* (holotype in Herb. Brit. Mus.).

A curious and distinct species characterized by the dense, capitulate clusters of minute, abnormal leaves which probably serve as a means of vegetative reproduction.

CAMPYLOPUS PORPHYREODICTYON (C. Muell.) Mitt.

Confluence of Rio's Toachi and Pilaton, *c.* 914 m., on branch and trunk of small tree ; *329*.

? CAMPYLOPUS BRACHYPHYLLUS Mitt.

E, on damp rock, 1,676 m.; *896*.

CAMPYLOPUS RICHARDI Brid.

C, Paramo, *c.* 3,505 m.; *719*.

PILOPOGONELLA LAEVIS (Tayl.) E. B. Bartr.

C, Paramo, *c.* 3,505 m.; *720*.

AMPHIDIUM CYATHICARPUM (Mont.) Broth.

A, 3,963–4,420 m.; *115a, 162, 374*. C, 3,505 m.; *718*.

DICRANOWEISIA FASTIGIATA (Tayl.) Paris.

A, on rock and in rock crevices near summit, 4,420–4,572 m.; *377, 406*.

LEUCOBRYACEAE

LEUCOBRYUM MARTIANUM (Hornsch.) Hampe.

Confluence of Rivers Toachi and Pilaton, *c*, 914 m., on tree ; 332.

ENCALYPTACEAE

ENCALYPTA COARCTATA Mitt.

A, in crevice of rock near summit, 4,420 m.; *390* in part.

POTTIACEAE

MOLENDOA ANDINA (Mitt.) Broth.

B, *c.* 1,829 m.; *589, 595, 596, 597, 633, 650*.

MERCEYA LIGULATA (Spruce) Schimp.

B, on calcareous bank of stream, *c.* 1,981 m.; 636. E, on wet rocks, *c.* 1,676 m.; 883, 895.

ANOECTANGIUM EUCHLORON (Schwaegr.) Mitt.

B, *c.* 1,829 m.; *607, 608, 610, 637*. E, 1,676 m.; *885, 901*.

HYMENOSTYLIUM STILLICIDIORUM (Mitt.) Broth.

E, 1,676 m.; *899, 900*. F, 2,347 m. *654*.

HYOPHILA TORTULA (Schwaegr.) Hampe.

E, 1,676 m.; *884*. B, 1,829 m.; *588*. D, 914 m.; *325*.

TRICHOSTOMUM CYLINDRICUM (Bruch) C. Muell.

A, 3,963 m.; *118a*. B, 1,829 m.; *583a, 619*. G, 3,109 m.; *51*. H, 2,591 m.; *869*. C, Paramo, on rock by stream, *c.* 3,505 m. ; *730, 724*, J, 2,438 m.; *301, 306*.

TRICHOSTOMUM AEQUATORIALE (Spruce) Dixon.

B, 1829–1981 m.; *585, 620, 638, 639.* A, in rock crevice near summit, 4,481 m.; *393.* J, 2,438 m.; *311.* C, 3,505 m. *721b.*

Trichostomum bellii E. B. Bartr., sp. nov.

Caespitosum, caespitibus densis, lutescenti-viridibus, intus fuscescentibus; *caulis* usque ad 4 cm. altus vage ramosus, dense foliosus; *folia* sicca arcte contorta, humida erecto-patentia, ad 3 mm. longa, e basi oblongo-ovata, flavescente, lineari-lanceolata, obtusa, minute apiculata; marginibus superne involutis, integerrimis; costa lutescente, percurrente; *cellulis* superioribus densis, minutis, obscuris, papillosis, basilaribus linearibus, flavescentibus, pellucidis, Caetera ignota.

Between Banos and Rio Verde, on damp rock, *c.* 1,676 m., 29th April, 1951, *891* (holotype in Herb. Brit. Mus.).

Possibly near *T. involutum* Sull., but distinct in the longer stems and larger leaves (3 mm. long instead of a scant 2 mm.) with the apex rounded and minutely apiculate.

LEPTODONTIUM FILIFORMIS (Lorentz) Steere.

C, Paramo, on thatch of cottage, 3,505–3,658 m.; *317, 729.* A, 4,496 m.; *398.*

LEPTODONTIUM GRACILE C. Muell.

A, around bases of shrubs, *c.* 3,109 m.; *124.*

LEPTODONTIUM DENSIFOLIUM (Mitt.) Mitt.

G, on bamboo, 3,109 m.; *63, 71.*

LEPTODONTIUM ACUTIFOLIUM Mitt.

A, in tussocks around low shrubs, *c,* 4,420 m.; *367a.*

LEPTODONTIUM ULOCALYX var. CIRRHIFOLIUM (Mitt.) E. B. Bartr.

H, *c.* 2,591 m., on a bank; *862.*

Leptodontium acutissimum E. B. Bartr. sp. nov.

Caespitosum caespitibus compactis, fuscescenti-viridibus; *caulis* erectus, irregulariter ramosus, usque ad 5·5 cm. altus; folia sicca flexuosa, adpressa, humida late patentia, 3 mm. longa, 1 mm. lata, e basi erecta, ovata, sensim tenuiter acuminata; marginibus ultra medium late revolutis, superne inaequaliter serrulatis; costa breviter excurrente, dorso superne minutissime papillosa vel laevi; *cellulis* superioribus rotundato-quadratis, diam. 7–8μ, papillosis, basilaribus sensim angustioribus, infimis linearibus, hyalinis, laevibus. Caetera ignota.

Pichincha, 4,420–4,572 m., 10th April, 1951, *369, 413* (holotype in Herb. Brit. Mus.).

These plants appear to differ from *L. calymperoides* Thér. in the shorter stems and shorter leaves. Here the leaves are slenderly acuminate, the costa percurrent or excurrent and the basal cells gradually becoming shorter upward not showing an abrupt transition to the small lamina cells.

Leptodontium stellaticuspis E. B. Bartr., sp. nov.

Gracile, caespitosum, caespitibus densis, depressis, lutescenti-viridibus ; *caulis* adscendens, usque ad 2 cm. longus, vage ramosus, laxe foliosus ; *folia* sicca erecto-flexuosa, humida late patentia, 1·2–1·8 mm. longa, ovato- lanceolata, in acumen breviusculum subito constricta, summo apicem dentibus hyalinis coronata ; marginibus ultra medium folii revolutis, superne irregulariter serratis ; costa in acumen evanida ; *cellulis* rotundatis, densis, haud incrassatis, diam. 7–8μ, minutissime pluripapillosis, basilaribus paulo majoribus, subquadratis. Caetera ignota.

San Juan, paramo, on thatch of cottage, *c.* 3,505 m., 25th April, 1951 ; *728* in part (holotype in Herb. Brit. Mus.). Pichincha, Paramo, in turf, 4,420 m.; *365* in part.

The leaf apex constricted to a short throat with a flaring rim crowned with sharp, hyaline teeth is a curious and unique feature that will clearly separate this species from any of its congeners.

HUSNOTIELLA REVOLUTA Cardot var. PALMERI (Cardot) Thér.

Quito, 3,048 m. on earth wall ; *182.*

DIDYMODON ARCUATUS (Mitt.) Broth.

H, 2,591 m.; *868.* B, *c.* 1,829 m. on rock by path ; *634.*

DIDYMODON JAMESONI (Tayl.) Broth.

G, 3,109 m.; *36b, 66, 70a.* A, 3,505–3,963 m.; *113, 126* form.

In typical *D. jamesoni* the upper leaf margins are sharply serrate while No. *113,* listed above as a form, shows the upper margins bluntly sinuate-toothed. This may be a phase influenced by environmental conditions. At any rate I doubt if the distinction is worthy of any particular rank.

Morinia ecuadorensis E. B. Bartr. sp. nov.

Sat robusta, caespitosa, caespitibus fuscescentibus, haud nitidis ; *caulis* erectus, usque ad 2 cm. altus, simplex vel parce ramosus ; *folia* conferta, fragilissima, sicca erecto-flexuosa, humida erecto-patentia, 5 mm. longa, e basi breviter oblonga sensim lineari-lanceolata, acuta ; marginibus inferne revolutis, superne inaequaliter crenatis ; costa infra summum apicem folii evanida ; *cellulis* superioribus bistratosis, rotundatis, obscuris, papillosis, diam *c.* 12μ, basilaribus anguste rectangularibus, hyalinis. Caetera ignota.

San Juan, Paramo, on rock by stream, 3,505 m., 25th April, 1951 ; *727* (holotype in Herb. Brit. Mus.).

The costal structure showing stereid bands on both sides of the median guide row together with the slender, brittle leaf points narrowly thickened at the margins and broken off on all but a few of the comal leaves are characters which in the aggregate suggest either *Morinia* or *Rhexophyllum,* but show anomalies with respect to both genera. These plants may represent a new generic concept, but in the absence of fruit I have tentatively referred them to *Morinia* although the bistratose lamina is an abnormal feature.

BARBULA ECUADORENSIS Broth.

G, 3,109 m.; *55, 57, 57a, 57c, 77.* A, on bank by stream, 3,505 m.; ***128.*** Lloa, 3,048 m.; *174.* H, 8,500 ft. *870.*

BARBULA RECTIFOLIA Tayl.

G, 3,109 m.; *43b* in part. C, *c.* 3,658 m., on a roadside bank ; *314a.*

BARBULA INEQUALIFOLIA Tayl.

C, 3,658 m.; *313b.* G, 3,109 m.; *57b* in part.

BARBULA CRUEGERI Sond.

D, 914 m.; *331.* E, *c.* 1,676 m.; *894.*

BARBULA REPLICATA Tayl.

A, 3,505 m.; *128a.* G, 3,109 m., *39, 76.* B, 1,829–1,981 m.; *617, 626, 637a.*

Desmatodon bellii E. B. Bartr. sp. nov.

Pusillus, caespitosus, caespitibus densis humilis, viridibus ; *caulis* erectus, vix 2 mm. altus, basi radiculosus ; *folia* sicca crispatula, incurva, humida erecto-patentia, spathulato-oblonga, obtusa, breviter mucronata, 1·5 mm. longa ; marginibus planis, integerrimis ; costa infra summum apicem folii evanida ; *cellulis* laminalibus rotundatis, obscuris, dense verrucosis, marginalibus 2–3 seriebus breviter oblongis, leniter papillosis, subpellucidis, limbum indistinctum efformantibus, basilaribus laxis, teneris, oblongo-rectangularibus, hyalinis. Caetera ignota.

Hacienda Pululagua, on a wall, *c.* 3,261 m.; 657. Near Hacienda Monjas, Concepcion, Pichincha, on a brick wall, 3,109 m., 28th March, 1951 ; *75* (holotype in Herb. Brit. Mus.).

The pellucid leaf border is suggestive of *D. porteri* James but the spathulate. obtuse leaves are sharply distinct.

STREPTOPOGON ERYTHRODONTUS (Tayl.) Wils.

A, on branch of small tree, 3,810 m.; *145.* H, 2,591 m. ; *873.*

STREPTOPOGON RIGIDUS Mitt.

B, *c.* 1,829 m., on branch ; *618.*

ALOINELLA CUCULLIFERA (Mitt.) Steere.

A, 4,115–4,267 m.; *106a* in part, *370a.*

TORTULA BOGOTENSIS (Hampe) Mitt.

A, 3,810 m.: *110.*

TORTULA CAROLINIANA Andrews.

G, on rock by road, 3,353 m.; *424.*

This is a remarkable extension of the range of this species, but I fail to find any tangible distinctions between this collection and the plants from N. America.

TORTULA DENTICULATA (Wils.) Mitt.

G, 3,109 m.; *57d.*

TORTULA ACULEATA (Wils.) Mitt.

A, 3,810–4,572 m.; *160, 400a, 371, 384.*

TORTULA FRAGILIS Tayl.
Quito, 3,048 m., on Cupressus sp., *177*. E, 1,076 m.; *898*.

TORTULA PICHINCHENSIS Tayl.
A, Paramo, 4,420 m.; *368, 372*.

GRIMMIACEAE

GRIMMIA RIVULARIOPSIS R. S. Williams.
A, 3,963–4,115 m.; *116, 120*.

GRIMMIA AFFINIS Hornsch.
A, 3,963 m.; *154, 155*.

GRIMMIA FUSCO-LUTEA Hook.
A, 3,963–4,572 m., on rocks, *153, 375, 378, 395, 409, 412, 726*.

RHACOMITRIUM CRISPULUM (Hook. f & Wils.) Hook. f & Wils.
A, 4,420–4,572 m.; *369h, 383, 407*.

FUNARIACEAE

ENTOSTHODON ACIDOTUS (Tayl.) C. Muell.
A, 3,963 m.; *119* in part, *166*. C, 3,505 m.; *717*.

FUNARIA SUBERECTA Mitt.
G, 3,109 m.; on a bank by path ; *47a*.

FUNARIA HYGROMETRICA var. CALVESCENS (Schwaegr.) Bry. Eur.
G, 3,109 m.; *44*. A, 3,658 m., *134b*.

SPLACHNACEAE

TAYLORIA SCABRISETA (Hook.) Mitt.
A, 4,481 m.; *390* in part.

BRYACEAE

MIELICHHOFERIA ANDINA Sull.
A, in crevices of rock near summit, 4481 m.; *391*.

MIELICHHOFERIA CAMPYLOCARPA (Hook. & Arn.) Mitt.
L, 3,658 m.; *924b*. A, in crevices of rocks near summit, 4,572 m.; *404*.

MIELICHHOFERIA NANA (Tayl.) Mitt.
A, 4,115–4,572 m.; *389, 392, 418, 106b* in part.

MIELICHHOFERIA LONGISETA C. Muell.
Tambillo, on mud wall, *c*. 1,524 m.; *903*. G, 3,109 m.; *73*. A, 3,810–4,572 m.; *115, 133, 376, 421*. C, 3,505–3,658 m.; *315* in part, *721* in part.

HAPLODONTIUM JAMESONI (Tayl.) Hampe.
L, roadside bank, 3,658 m.; *924a*.

HAPLODONTIUM DIPLODONTIUM (Mitt.) Jaeg.
G, on bank by track, 3,109 m.; *35*. San Juan, Paramo, *c*. 3,505 m.; *716, 315* in part.

Pohlia papillosa (C. Muell.) Broth.
A, 3,505–4,115 m.; *117a, 130.* C, 3,658 m.; *316.*

Brachymenium crinitum (Mitt.) Jaeg.
Quito, 3,048 m.; *179a.*

Brachymenium speciosum (Hook. & Wils.) Steere.
C, Paramo, 3,505 m.; *721a.*

Acidodontium ramicolum (Spruce) Jaeg.
H, on shaded branches of trees, *c.* 2,591 m.; *874.*

Acidodontium subrotundum Hook. & Wils.
G, on soil on shaded bank, 3,109 m.; *74.*

Acidodontium seminerve Hook. & Wills.
H, 2,591 m.; *867a.*

Anomobryum filiforme (Dicks.) Husn.
Quito, 3,048 m.; *175.* A, 3,810–4,115 m.; *120a, 156b.* G, 3,109 m. *43, 43b* in part.

Anomobryum prostratum (C. Muell.) Besch.
C, Paramo, *c.* 3,505 m.; *722, 725, 925* in part.

Anomobryum semiovatum (Brid.) Jaeg.
G, 3,109 m.; *57b.* B, on damp bank, *c.* 1,981 m.; *646.*

Bryum cruegeri Hampe.
K, 914 m.; *295.* B, 1,981 m.; *642.*

Bryum argenteum Hedw.
L, *924.* A, 3,658–4,420 m.; *134, 366.* G, 3,109 m.; *47b.*

Bryum candicans Tayl.
C, on thatch, 3,658 m.; 318.

Bryum sericeum Mitt.
B, *c.* 1,829 m.; on rocky bank; *598.*

Bryum subpilosum Mitt.
A, on soil on bank by path, *c.* 3,658 m., *131.*

Bryum concavum Mitt.
B, on loamy bank, *c.* 1,829 m., *628.*

Bryum erythroneuron Mitt.
A, on bank by stream, *c.* 3,505 m.; *123, 163.*

Bryum capillare Hedw.
J, 2,438 m.; *300b.*

Bryum andicola Hook.
G, 3,109 m.; *38a.*

Rhodobryum beyrichianum (Hornsch.) Schimp.
B, 1,829 m.; *609.* D, 914 m.; *322.*

Rhodobryum grandifolium (Tayl.) Schimp.
A, on rich soil at base of shrubs, *c.* 3,810 m. *148.* G, 3,109 m.; *59.*

MNIACEAE

Mnium longirostrum Brid.
G, 3,109 m.; *40b, 42c, 62.* J, 2,438 m.; *300.* D, 914 m.; *327a.*

BARTRAMIACEAE

Anacolia laevisphaera (Tayl.) Flowers.
A, 3,505–4,115 m.; *113a, 121, 127, 165, 169a* in part. M, 2,347 m.; *653.* G, 3,109 m.; *38.*

Bartramia potosica Mont.
A, 3,963–4,572 m.; *152, 400b.*

Bartramia flavicans Mitt.
C, 3,505 m.; *727a.*

Bartramia mathewsii Mitt.
A, 3,963–4,420 m.; *118, 157, 373.* C, 3,658 m.; *316b.*

Philonotis glaucescens (Hornsch.) Paris.
B, 1,981 m.; *643.*

Philonotis sphaericarpa (Hedw.) Brid.
J, 2,438 m.; *302.*

Philonotis rufiflora (Hornsch.) Jaeg.
N, 1,829 m.; *925* in part. K, 914 m.; *293.*

Philonotis scabrifolia (Hook. f. & Wils.) Broth.
A, 3,810 m.; *159a.*

Breutelia allionii Broth.
A, on a tree, *c.* 3,810 m.; *141.* Amongst grass near summit. 4,420 m.; *379.* E, 1676 m.; *887b.*

Breutelia tomentosa (Hedw.) Paris.
P, 2,591 m.; *731.*

Breutelia integrifolia (Tayl.) Jaeg.
A, 3,963 m.; *116a, 167.*

Breutelia scariosula (C. Muell.) Broth.
C, Paramo, 3,505 m.; *715.*

ORTHOTRICHACEAE

Zygodon reinwardtii (Hornsch.) A. Braun.
A, 3,658–4,115 m.; *108, 150a, 173.* G, 3,109 m.; *54.* H, 2,591 m.; *926.*

Zygodon goudotii Hampe.
A, 3,810–3,963 m.; *109, 110a, 171.*

Zygodon fasciculatus Mitt.
A, 3,810 m.; *150b.*

Zygodon subsquarrosus Broth.
A, on a small tree, 3,810 m.; *150.*

Zygodon stenocarpus var. linearifolius (Mitt.) Malta.
C, *c.* 3,810 m.; *48d.*

ZYGODON PICHINCHENSIS (Tayl.) Mitt.
A, 4,496–4,572 m.; *381, 383, 386.*

I have not seen the type of *Triquetrella spiculosa* Thér., but the description and figures strongly suggest that it may be *Z. pichinchensis*, particularly so as this species does not appear in the Benoist collections.

ORTHOTRICHUM ELONGATUM Tayl.
A, 3,810 m.; *139, 145a.* H, 2,591 m.; *873a.*

ORTHOTRICHUM UNDULATUM Mitt.
A, on a tree, *c.* 3,810 m.; *112a.*

MACROMITRIUM LONGIFOLIUM (Hedw.) Brid.
P, 2,438 m.; *732.*

MACROMITRIUM LAEVISETUM Mitt.
G, on tree trunk, 3,109 m.; *49*, 67.

? MACROMITRIUM CRISPATULUM Mitt.
E, 1,676 m.; *902* sterile.

MACROMITRIUM SERRULATUM Mitt.
M, *c.* 2,347 m.; on a small tree ; *651.*

RHACOPILACEAE

RHACOPILUM TOMENTOSUM (Hedw.) Brid.
B, 1,829 m.; *580a, 621, 621a.* K, 914 m.; *291.*

CRYPHAEACEAE

ACROCRYPHAEA RUBRICAULIS (Mitt.) Jaeg.
B, *c.* 1,829 m.; on rock ; *615a.*

CRYPHAEA PILIFERA Tayl.
A, 3,810 m.; *143, 144.* H, 2,591 m.; *874a.*

CRYPHAEA RAMOSA Wils.
A, amongst grass by path, *c.* 3,505 m ; *125.* G, 3,109 m.; *49a, 67c.*

LEPYRODONTACEAE

LEPYRODON TOMENTOSUS (Hook.) Mitt.
A, 4,420–4,572 m.; *379* in part, *415.*

PRIONODONTACEAE

PRIONODON DENSUS (Hedw.) C. Muell.
H, 2,591 m. ; *872.* F, 2,347 m.; *656.*

PRIONODON LUTEOVIRENS (Tayl.) Mitt.
G, 3,109 m.; *60, 69.* H, 2,591 m.; *881.*

PRIONODON FUSCO-LUTESCENS Hampe.
G, 3,109 m.; *48.*

PRIONODON PATENTISSIMUS Besch.
B, 1,829 m.; *590.*

PRIONODON PINNATUS Hampe.
H, 2,591 m ; *932.*

PTEROBRYACEAE

PTEROBRYUM DENSUM (Hedw.) Hornsch.
Quinde-Pacha, above Puela, N.W. slopes of Tungurahua, *c.* 2,591 m, on a tree; *927.*

METEORIACEAE

SQUAMIDIUM NIGRICANS (Hook.) Broth.
B, 1,829 m.; *590a, 603a, 612, 614.* H, 2,591 m.; *860a, 876.* J, 2,438 m., *299b.* K, 914 m.; *294a.* G, *60c, 48b.*

SQUAMIDIUM CAROLI (C. Muell.) Broth.
B, on twig of a small tree, *c.* 1,981 m.; *648.*
This appears to be the first record of this species on the mainland.

PAPILLARIA NIGRESCENS forma APPRESSA (Hornsch.) E. B. Bartr.
B, 1,829 m.; *586.*

PAPILLARIA IMPONDEROSA (Tayl.) Broth.
J, *c.* 2,438 m., on a roadside bank; *304.*

PAPILLARIA LAEVIFOLIA (Mitt.) Broth.
Banos, *c.* 1,829 m., on a stone wall; *888.*

METEORIUM ILLECEBRUM (C. Muell.) Mitt.
P, 2,438 m.; *731a.*

BARBELLA TENUISSIMA (Hook. f. & Wils.) Fleisch.
G, *48a, 68.*

LINDIGIA DEBILIS (Mitt.) Jaeg.
H, *877a, 878.*

LINDIGIA ACICULATA (Tayl.) Hampe.
A, 3,810 m.; *136a.* G, *53a* in part. B, 1,981 m.; *640.* H, *867.*

METEORIOPSIS PATULA (Hedw.) Broth.
J, *299a.*

METEORIOPSIS REMOTIFOLIA (Hornsch.) Broth.
B, *605a.*

NECKERACEAE

NECKEROPSIS UNDULATA (Hedw.) Reichardt.
D, *319a.*

? NECKERA ANDINA Mitt.
A, 3,510 m.; *137b.*

NECKERA LINDIGII Hampe.
H, on shaded branches of tree, *c.* 2,591 m.; *877* in part.

NECKERA JAMESONI Tayl.
H, *877* in part.

NECKERA OBTUSIFOLIA Tayl.
A, 3,810 m.; *112.* G, *48c.*

POROTRICHUM LONGIROSTRE (Hook.) Mitt.
G, *61a.*

? POROTRICHUM KORTHALSIANUM (Dozy & Molk.) Mitt.
D, *321b.*

LEMBOPHYLLACEAE

POROTRICHODENDRON NITIDUM (Hampe) Broth.
H, *871.*

POROTRICHODENDRON SUPERBUM (Tayl.) Broth.
G, *60a, 72a.* F, *655.* H, *880.*

PILOTRICHACEAE

PILOTRICHUM BIPINNATUM (Schwaegr.) Mitt.
D, on rocks, *c.* 914 m.; *320a.*

HOOKERIACEAE

DALTONIA JAMESONI Tayl.
A, 4,481–4,572 m.; *397, 410.*

DALTONIA BILIMBATA Hampe.
G, *71a, 137* in part.

DALTONIA TRACHYODONTA Mitt.
A, *135b, 137* in part.

DALTONIA LINDIGIANA Hampe.
A, *137* in part.

CYCLODICTYON CAPILLATUM (Mitt.) Broth.
G, *50, 50a.*

LEPIDOPILUM POLYTRICHOIDES (Hedw.) Brid.
D, *319.*

HYPOPTERYGIACEAE

HYPOPTERYGIUM TAMARISCINUM (Hedw.) Brid.
B, *623.* G, *42.*

FABRONIACEAE

FABRONIA ANDINA Mitt.
Puela, 2,438 m.; *889.* G, *422.* Quito, 3,048 m.; *179, 181.*

LESKEACEAE

LESKEA ANGUSTATA Tayl.
Puela, 2,438 m.; *890.* Quito, 3,048 m.; *178, 176.*

THUIDIACEAE

RAUIA TERETIUSCULA (Mitt.) Broth.
B, 1,829–1,981 m.; *632, 645.*

THUIDIUM CYLINDRICUM Mitt.
G, *53b, 72.* H, *930.*

THUIDIUM PERUVIANUM Mitt.
A, 3,505–3,963 m ; *124a, 142, 149, 169a* in part. G, *59a*. H, *875*.

THUIDIUM DELICATULUM (Hedw.) Mitt.
K, *c.* 914 m., on bank by roadside ; *294*.

THUIDIUM PSEUDODELICATULUM (C. Muell.) Jaeg.
B, 1,829 m.; *584, 625*. D, *321, 323*. E, *887*. J, *300a*.

BRACHYTHECIACEAE

PLEUROPUS LESKEOIDES (Hook.) Steere.
A, 4,572 m.; *400, 407*. G, *60b*.

BRACHYTHECIUM STEREOPOMA (Spruce) Jaeg.
G, *587, 611, 613, 649a*. E, *887a* in part.

BRACHYTHECIUM LAETUM (Brid.) Bruch & Schimp.
A, 3,658–3,810 m.; *111, 135a*.

BRACHYTHECIUM CONOSTOMUM (Tayl.) Spruce.
G, *37, 40a, 65*.

RHYNCHOSTEGIUM INERME (Mitt.) Jaeg.
A, 3,810 m.; *136*.

RHYNCHOSTEGIUM LAMASICUM (Spruce) Jaeg.
B, *c.* 1,829 m., on a branch ; *594*.

EURHYNCHIUM PULCHELLUM (Hedw.) Jennings.
G, *42a, 61c*.

EURHYNCHIUM CAMPYLOCARPUM (C. Muell.) De Not.
B, 1,829 m.; *584a*.

ENTODONTACEAE

ENTODON JAMESONI (Tayl.) Mitt.
G, *53c, 64, 74a*. A, 3,810 m.; *147*. Quito, 3,048 m.; *183*.

SEMATOPHYLLACEAE

SEMATOPHYLLUM CAESPITOSUM (Hedw.) Mitt.
D, *326*.

SEMATOPHYLLUM CUSPIDIFERUM Mitt.
H, *928*. K, *292*.

ACROPORIUM PUNGENS (Hedw.) Broth.
D, *330*.

ACROPORIUM PUNGENS var. STILLICIDIORUM (Broth.) Steere.
H, *929*.

TAXITHELIUM PLANUM (Brid.) Mitt.
B, 1,829 m.; *624a*.

HYPNACEAE

Hypnum cupressiforme var. lacunosum (Mitt.) Delogne.
A, 3,505–4,420 m.; *106b*, in part, *122, 156, 161, 169, 382.*

Taxiphyllum planissimum (Mitt.) Broth.
G, *581a.*

Vesicularia vesicularis (Schwaegr.) Broth.
D, *321a.*

Ctenidium malacodes Mitt.
J, on a roadside bank, *c.* 2,438 m.; *302a.*

Mittenothamnium reptans (Hedw.) Cardot.
G, *40, 50b, 53a, 65a.* D, *320.* B, 1,829 m.; *580.* H, *931.*

POLYTRICHACEAE

Pogonatum obscuratum Mitt.
H, on a bank, *c.* 2,591 m.; *863.*

Pogonatum oligodus (Kunz.) Mitt.
A, 4,115–4,267 m.; *107, 370.*

Polytrichum juniperinum Hedw.
G, *38b, 45, 46, 58b.* J, *298a.* A, 3,963 m.; *117b.*

Polytrichadelphus aristatus (Hampe) Mitt.
A, 3,810–4,420 m.; *133a, 156a, 374a.*

PERTINENT LITERATURE

Bartram, E. B. 1934. Mosses of the River Napo, Ecuador. *Rev. Bryol and Lichén.*, n.s., vi : fasc. 1–4, 9–18.

Brotherus, V. F. 1921. Contributions à la flore bryologique de l'Ecuador. *Rev. Bryol.* 1920, 1 : 1–16.

Mitten, W. 1869. Musci Austro-americani. *Journ. Linn. Soc. Bot.* xii : 1–659.

Steere, W. C. 1948. Contributions to the Bryogeography of Ecuador ; I. A review of the species of Musci previously reported. *The Bryologist* li, 3 : 65–167.

Thériot, I. 1936. Mousses de l'Equateur. *Rev. Bryol and Lichén.*, n.s., ix : fasc. 1–2, 5–36.

BRITISH MUSEUM NATURAL HISTORY
PRESENTED
13 DEC 1955

PRINTED IN GREAT BRITAIN BY
ADLARD AND SON, LIMITED,
BARTHOLOMEW PRESS, DORKING

NOVITATES HIMALAICAE—I

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 3
LONDON: 1956

NOVITATES HIMALAICAE—I

Xuy

Pp. 65–81 ; *Pls.* 1–8 ; 11 *Text-figs.*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 3
LONDON : 1956

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

Parts will appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, *No.* 3 *of the Botanical series.*

BRITISH MUSEUM
1 [illegible] 1956
NATURAL HISTORY

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued October 1956 *Price Ten Shillings*

NOVITATES HIMALAICAE—I

It is intended to publish from time to time descriptions of new species and interesting records of plants represented in the extensive collections which have accumulated during recent years in the British Museum from the Himalayas and neighbouring regions. Two papers, one on *Cotoneaster* and the other on *Pedicularis*, have already appeared but the series now begun will include random selections as they become available and the descriptions and records will not be based exclusively on material preserved in the British Museum.

POTENTILLA ARBUSCULA D. Don, *Prodr. Fl. Nepal*: 256 (1825). (*Rosaceae*)

Var. **unifoliolata** Ludlow, var. nov (Plate 1 and Fig. 1.); a typo (var. *arbuscula*) foliis plerumque unifoliolatis recedit.

Frutex c. 1 m. altus, ramis erectis, cortice brunneo vel griseo. *Folia* numerosa, unifoliolata (raro bifoliolata); foliolum obovatum vel late ellipticum, apice mucronulatum, 7–15 mm. longum, 4–8 mm. latum, demum glabrum vel pilis longis sparse vel in pagina inferiore ad costam plus minusve dense vestitum, venis sub lente conspicuis. *Flores* magni, ad 3 cm. lati, terminales, solitarii. *Epicalycis* segmenta late ovata vel late elliptica, apice rotundata vel retusa vel emarginata, viridia sed saepe rubro-venosa. *Sepala* ovata, acuta, sparse pilosa, dimidio inferiore

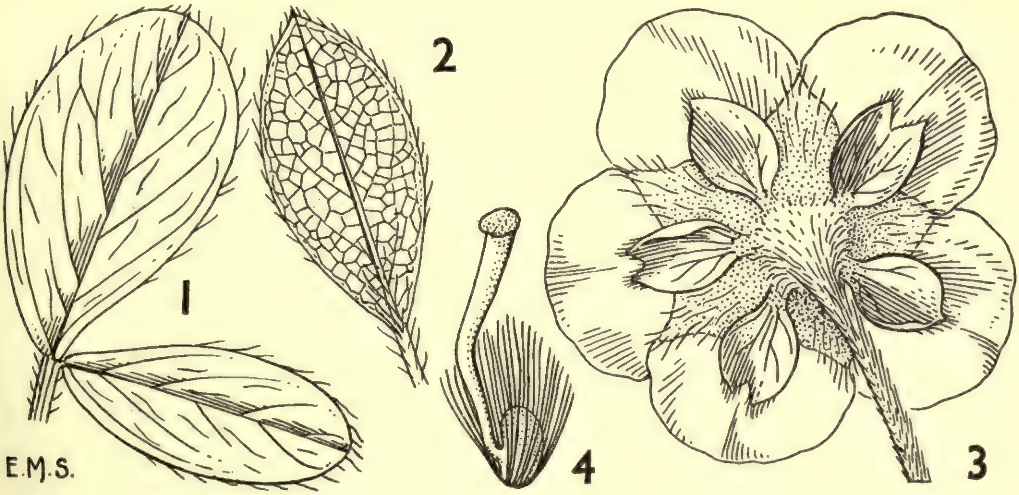


FIG. 1.—*Potentilla arbuscula* var. *unifoliolata* Ludlow. 1. Bifoliolate leaf (upper surface) (× 4). 2. Unifoliolate leaf (under surface) (× 4). 3. Flower (× 2). 4. Ovary and style (× 15).

extrinsecus flavo, dimidio superiore extrinsecus atro-rubro. *Petala* aurea, 8–12-mm., longa, 7–11 mm. lata.

BHUTAN. Saga La, upper Mangde Chu (lat. 27° 55′ N., long. 90° 26′ E.), alt. 4,270 m.; shrub 3–4 ft. high in boulder scree; calyx-segments alternately dark red and green; corolla yellow; 15th July, 1949, *Ludlow, Sherriff & Hicks* 16855 (holotype in Herb. Brit. Mus.). Dungshinggang (Black Mountain), central Bhutan; alt. 3,960 m.; on very rocky hillside among dwarf juniper; shrub 2–3 ft.; corolla golden yellow; 20th June, 1937, *Ludlow & Sherriff* 3290.

This handsome shrub, with solitary yellow flowers 2–3 cm. in diameter, is unique among the *Fruticosae* group of *Potentilla* in having the leaves normally reduced to a single leaflet. Only rarely are the leaves bifoliolate, and no trifoliolate leaves have been found on the two gatherings available. They agree with typical *P. arbuscula* in having the blade of the leaflet sparsely hairy or almost glabrous below with the network of veins clearly evident.

[F. Ludlow]

Potentilla bhutanica Ludlow, sp. nov. (Fig. 2.) (*Rosaceae*)

Fruticulus caespitosus 6–12 cm. altus; caudex lignosus, brevis, squamis et residuis castaneis petiolorum stipularumque obtectus; caules floriferi ascendentes

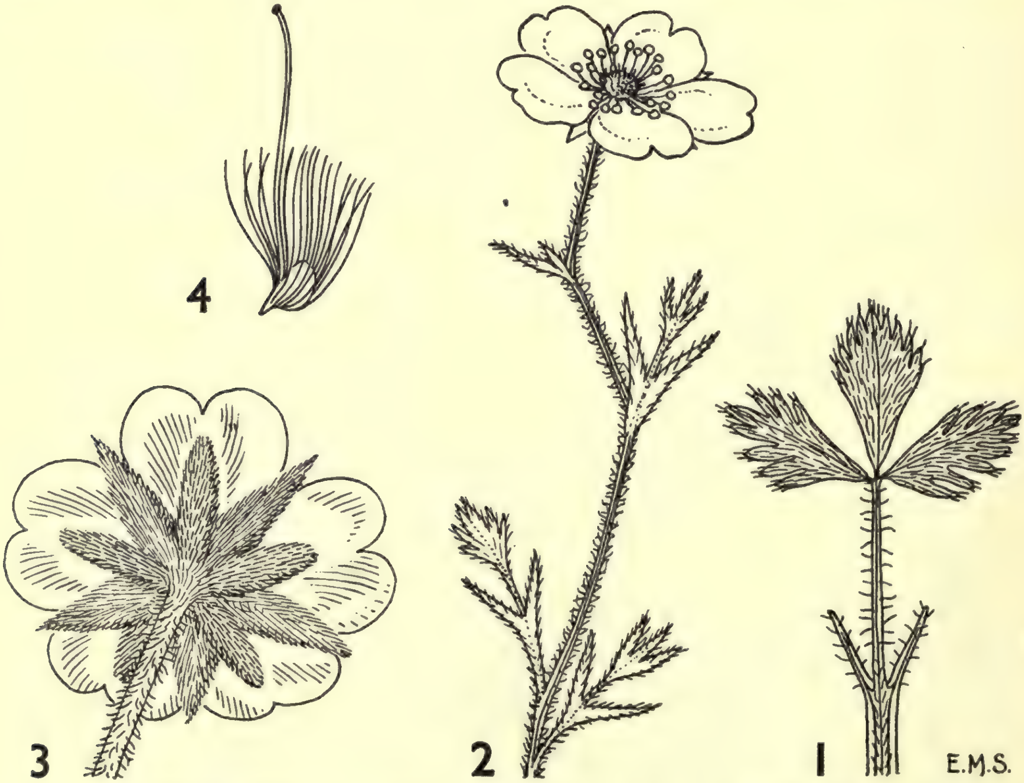


FIG. 2.—*Potentilla bhutanica* Ludlow. 1. Basal leaf (1½ NS). 2. Flowering stem (1½NS). 3. Flower (× 2). 4: Ovary and style (× 15).

vel erecti, simplices, 1-flori, 1–6 cm. alti, foliis 1–3 parvis unifoliolatis muniti, longe pilosi. *Folia* basalia permulta, trifoliolata, petiolo incluso 2–5 cm. longa, dense sericeo-tomentosa ; foliola lateralia sessilia, inaequilateralia, ambitu fere obovata, basi oblique cuneata, pinnatifida lobis oblongo-lanceolatis acutis exterioribus 3–5 interioribus 2–3, c. 12 mm. longa 8 mm. lata ; foliolum terminale breviter petiolulatum, pinnatifidum lobis 5–13, foliolis lateralibus paulo longius ; petiolus longe pilosus, ad 3·5 cm. longus ; stipulae longe adnatae, plerumque castaneae, appendicibus lanceolatis acuminatis integris. *Flores* magni, 2–2·5 cm. lati, terminales, solitarii. *Epicalycis* segmenta anguste oblongo-elliptica, obtusa vel subacuta, c. 7 mm. longa, 2 mm. lata utrinque sericea. *Sepala* lanceolata, acuta, c. 8 mm. longa, 2·5 mm. lata, extus sericea, intus glabra. *Petala* lutea, latissime obovata, apice obcordata, c. 10–12 mm. longa et lata. *Stamina* c. 20 ; filamenta glabra ; antherae subrotundae, c. 0·5 mm. longae et latae. *Receptaculum* villosum. *Carpella* minuta, ovario pilis longis villoso ; stylus lateralis sed sub-terminails per totum filiformis, stigmate exiguo.

BHUTAN. Head of the western branch of the Pho Chu (lat. 27° 57′ N., long. 90° E.), alt. 4,270 m. ; on rocks and cliffs; calyx green, some segments tipped brown ; corolla yellow ; anthers yellow ; 24th June, 1949, *Ludlow, Sherriff & Hicks* 16623 (holotype in Herb. Brit. Mus.).

This handsome dwarf species belongs to *Potentilla* subsect. *Nematostylae* ser. *Suffruticulosae* Th. Wolf with *P. eriocarpa* Wall. ex Lehm. as its near ally. It is readily distinguished from that species by its thick sericeous indumentum, strongly toothed leaflets, bright-chestnut stipular sheaths, and dense foliage totally concealing the stems.

[F. Ludlow]

Aster retusus Ludlow, sp. nov. (Fig. 3.) (*Compositae*)

Herba perennis humilis, breviter stolonifera ; caudex praemorsus, stolones ad 20 mm. longus et 1·5 mm. crassos emittens ; caulis florifer simplex, 4–8 cm. altus, basi sparse pilosus, superne pilis rufo-purpureis multicellularibus dense vestitus. *Folia* basalia rosulata, spathulata, apice rotundata retusa, margine integra interdum paulo ciliata, basi sensim in petiolum brevem attenuata, 1–3 cm. longa, 4–8 mm. lata, glabra ; folia caulina 3–4, ascendentia, sessilia, oblanceolata, 1–2 cm. longa, 2–4 mm. lata, margine interdum ciliata, ceterum glabra. *Capitulum* solitarium, 3–4·5 cm. latum ; involucri phylla 2–3-seriata, exteriora lanceolata, interiora linearia, acuta vel acuminata, 6·5–9 mm. longa, 1·5–2·5 mm. lata, apice purpurea recurva, margine purpurea et ciliata, ceterum glabra. *Flores radii* ♀, c. 25 ; corolla malvino-purpurea, tubo 3 mm. longo, ligula 16–18 mm. longa, 1·5 mm. lata. *Flores disci* ♂ ♀, numerosi ; corolla c. 5·5–6 mm. longa, lobis acutis c. 0·75 mm. longis. *Achaenia* oblonga, parce hirsuta c. 1·5 mm. longa, 0·5 mm. lata ; pappi duplicis setae exteriores c. 1 mm. longae, interiores corollae disci aequilongae vel ea paulo longiores flavidae barbellatae.

S.E. TIBET. Nambu La (lat. 29° 59′ N., long. 94° 26′ E.) ; alt. 4,260 m. 18th July, 1947, on rocks ; ray florets mauve ; *Ludlow, Sherriff & Elliott* 15467 (holotype in Herb. Brit. Mus.).

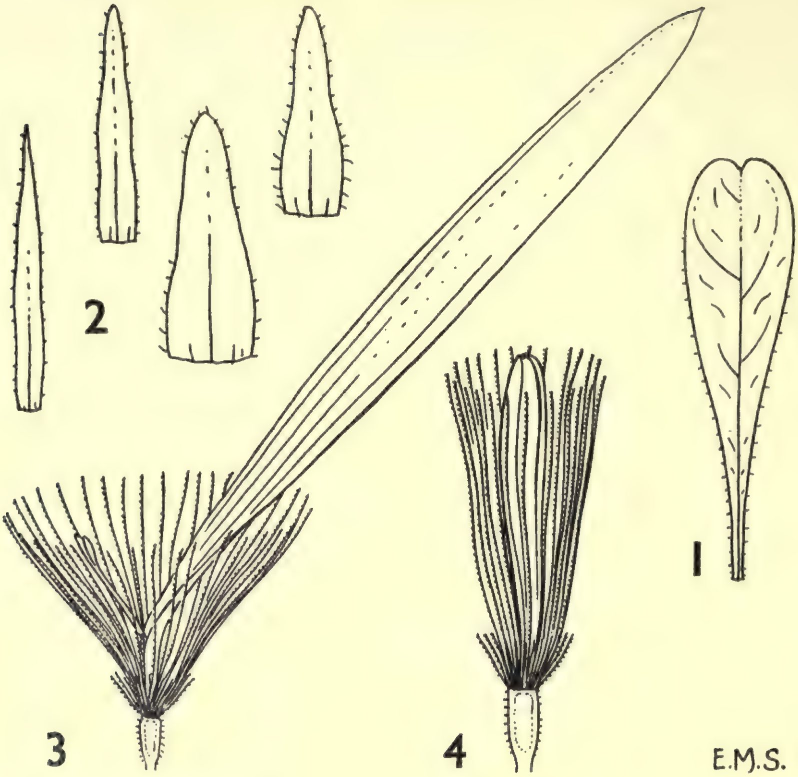


FIG. 3.—*Aster retusus* Ludlow. 1. Leaf (× 2). 2. Involucral segments (× 4). 3. Ray floret (× 8). 4. Discfloret (× 8).

This little alpine species belongs to *Aster* subsect. *Heterochaeta* Onno. It is easily recognized by its retuse densely rosulate radical leaves. Its nearest relative is *A. salwinensis* Onno, but it differs from that plant in its retuse glabrous leaves which are always entire and never, even remotely, denticulate; and also in its phyllaries which are quite glabrous except for a ciliate margin.

[F. Ludlow]

Saussurea chrysotricha Ludlow, sp. nov. (Plate 2 and Fig. 4.) (*Compositae*)

Herba perennis; caudex ramosus, ramis brevibus apice petiolis angustis marcidis involucratis; caulis florifer erectus, simplex, 20–30 cm. altus, apicem versus leviter dilatatus et infra capitulum 5–6 mm. latus, pilis 2–3 mm. longis flavis mollibus patentibus vestitus. *Folia* basalia numerosa, linearia, acuta, integra, basi in petiolum longum alatum attenuata, 25–35 cm. longa, 1–2 cm. lata, ut caulis pilis longis flavis utrinque vestita, costa conspicua, venis ceteris obscuris; petiolus basi in vaginam expansus; *folia* caulina 1–2, illis basalibus conformia sed sessilia et minora. *Capitulum* solitarium, 2–3 cm. longa et lata. *Involucri* phylla viridi-purpurea; exteriora 20–25 mm. longa e basi anguste ovata c, 2·5–4 mm. lata in appendicem

filiformem longam pilosam contracta; interiora anguste lanceolata, acuta vel acuminata, 20–24 mm. longa, basi 2–3 mm. lata, inferne glabra, superne pilosa. *Receptaculi* setae 0·5–1 mm. longae. *Flores* numerosi; corolla caeruleo-purpurea, tubo c. 14 mm. longo primum basi leviter dilatato deinde per 10 mm. angustata tum per 3 mm. campanulato, lobis linearibus c. 6 mm. longis. *Antherae* c. 6–7 mm. longae; appendicibus villosis c. 2 mm. longis. *Achaenia* brunnea, glabra, c. 3 mm. longa; pappi setae biseriatae, exteriores scabridae ad 3 mm. longae, interiores plumosae ad 14 mm. longae.

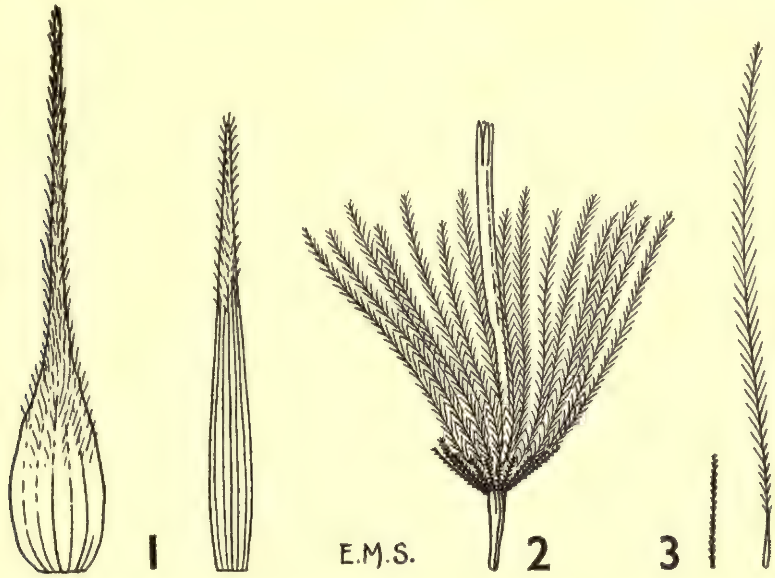


FIG. 4.—*Saussurea chrysotricha* Ludlow. 1. Outer and inner involucral segments (× 3). 2. Pappus and achene (× 3). 3. Outer and inner pappus hairs (× 5).

NEPAL. Khaptang, Mugu Khola (lat. 29° 55′ N., long. 82° 35′ E.); alt. 4,500 m.; growing between boulders on open stony slopes; leaves and stem pale green with fine yellow hairs; phyllaries dark brown; 21st August 1952, *Polunin, Sykes & Williams* 5374. East of Chalike Pahar (lat. 28° 40′ N., long. 83° 05′ E.); alt. 4,300 m.; summer grazing encampments; leaves yellowish hirsute; 2nd August, 1954, *Stainton, Sykes & Williams* 3720 (holotype in Herb. Brit. Mus.).

This striking plant grows amidst boulders in alpine pastures above the tree zone. Its nearest relative would appear to be *Saussurea glanduligera* Schultz Bip. from which it is readily distinguished by the soft dense yellow indumentum covering the entire plant, by the fewer cauline leaves, the absence of a wholly white tomentum amidst the dried up bases of the radical leaves, and the long filiform tips of the outer involucral segments.

[F. Ludlow]

Saussurea linearifolia Ludlow, sp. nov. (Plate 3 and Fig. 5). (*Compositae*)

Herba perennis caespitosa; caudex lignosus ramosus, ramis brevibus apice petiolis marcidis involucratis; caulis florifer erectus simplex, validus, 20–30 cm. altus, 3–5 mm. crassus, inferne laxe superne densius villosus, viridi-purpureus vel rubro-purpureus, *Folia* basalia numerosa, linearia, apice acuta, margine irregulariter sinuata et remote leviterque dentata, basi dilatata vaginantiaque, 15–30 cm. longa, 1–1·7 cm. lata, glabra vel interdum ad marginem glanduloso-pubescentia, costa utrinsecus prominenti; folia caulina 3–8, quoad magnitudinem coloremque variabilia, ima interdum illis basalibus omnino conformia, media illis breviora et minus dentata viridi-purpurea vel purpurea, superiora sessilia anguste ovata vel lanceolata integra vel interdum leviter dentata glabra vel interdum sparse villosa rubropurpurea. *Capitulum* solitarium, 2–4 cm. longa, 2–3 cm. lata; involucri phylla nigra vel atro-purpurea vel viridipurpurea, acuta, dense vel sparse villosa, exteriora lanceolata vel anguste ovata 12–14 mm. longa et 4–5 mm. lata, media lanceolata vel anguste lanceolata 12–15 mm. longa et 3–3·5 mm. lata, interiora linearia 15–17 mm. longa et 1–1·75 mm. lata. *Flores* numerosi; corolla caeruleo-purpurea, tubo 8–10 mm. longo inferne angusto superne campanulata, lobis linearibus 5–6 mm. longis. *Antherae* c. 5 mm. longae, appendicibus albovillosis c. 2 mm. longis. *Achaenia* brunnea, glabra, c. 3–4 mm. longa; pappi setae plerumque biseriatae, exteriores scabridae 2–3 mm. longae, interiores plumosae 11–14 mm. longae.

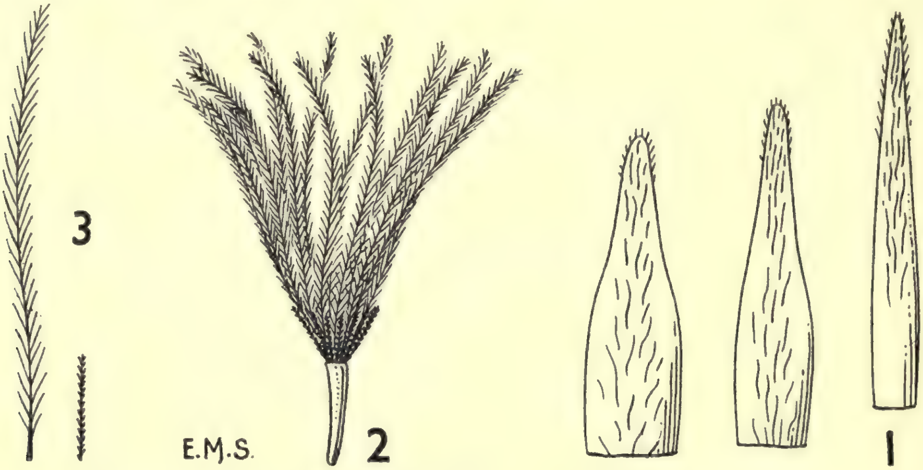


FIG. 5.—*Saussurea linearifolia* Ludlow. 1. Involucral bracts (× 3). 2. Pappus and achene (× 3). 3. Inner and outer pappus hairs (× 5).

NEPAL. Rohagaon Suli Gad (lat. 28° 59′ N., long. 82° 55′ E.), alt. 3,300 m., open grassy slopes; stems red with white hairs; pappus fawn, 14th September, 1952, *Polunin, Sykes & Williams* 3387 (holotype in Herb. Brit. Mus.). Near Dogadi Khola (lat. 28° 43′ N., long. 83° 2′ E.) alt. 4,200 m., steep rock and grass slope; inflorescence blue-purple; bracts reddish green; 6th August, 1954. *Stainton, Sykes & Williams* 3777. Tukucha, Kali Gandaki (lat. 28° 43′ N., long. 83° 38′ E.), alt. 4,050 m., amongst stones on scree slopes; involucre black and covered with white hairs; inflorescence mauve; stem and bracts purple; 10th September, 1954, *Stainton, Sykes & Williams* 7749. Above Dogadi Khola, alt. 4,200 m., steep rocks and grass slopes; seed collected; 26th September, 1954, *Stainton, Sykes & Williams* 4597.

This species is closely related to *Saussurea uniflora* (DC.) Wall. ex C. B. Clarke but is readily distinguished by its long linear radical leaves, which are irregularly sinuate and shallowly and distantly toothed.

In the Kew Herbarium there is a gathering by Duthie (No. 3080) from the Dhauli Valley near Rama in Kumaon, which appears similar in all respects except that the radical leaves are narrowly oblanceolate.

[F. Ludlow]

Saussurea platyphyllaria Ludlow, sp. nov. (Plate 4 and Fig. 6.) (*Compositae*)

Herba perennis nana; caudex lignosus, petiolis latis marcidis brunneis involucratus; caulis florifer brevissimus, c. 0·5–1·5 cm. longus, basibus foliorum occultus. *Folia* omnia rosularia, oblanceolata vel elliptica, apice obtusa, margine leviter repando-dentata dense ciliata, basi in petiolum alatum sensim angustata, 4–9 cm. longa, 0·7–2 cm. lata, supra glabra, subtus secus venas sparse villosa; petiolus in vaginam membranaceam pallidam nitidam expansus. *Capitulum* plerumque solitarium (raro capitula duo), subsessile, c. 3 cm. longum, 2·5 cm. latum. *Involucri* phylla triseriata, sparse villosa; exteriora ovata vel angusta ovata, obtusa, 15–17·5 mm. longa, 8–10 mm. lata purpurea; media lanceolata vel anguste lanceolata; interiora linearia, acuta, 18–20 mm. longa, 1·5–2 mm. lata, margine et apice purpurea. *Receptaculi* setae

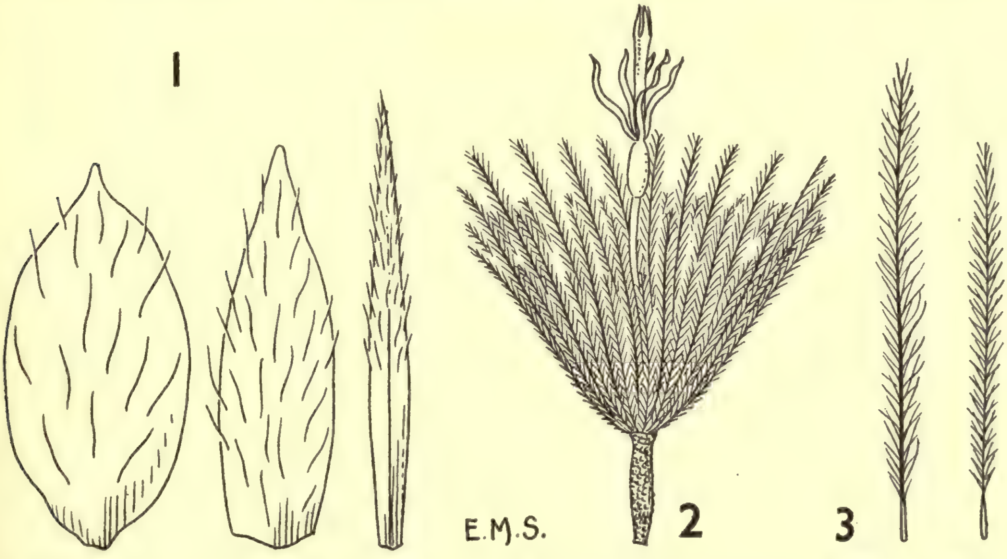


FIG. 6.—*Saussurea platyphyllaria* Ludlow. 1. Involucral bracts (× 3). 2. Flower with pappus and achene (× 3). 3. Inner and outer pappus hairs (× 5).

subulatae, 3–4 mm. longae. *Flores* numerosi; corolla purpurea, tubo c. 12 mm. longo primum basi leviter dilatato deinde per 8–9 mm. angustato tum per 3 mm. campanulato, lobis linearibus c. 5 mm. longis. *Antherae* c. 6 mm. longae, nigrae, appendicibus albis 1 mm. longis. *Achaenia* nigra, muricata, c. 2·5 mm. longa; pappi setae biseriatae, plumosae, exteriores 9–11 mm. longae, interiores 12–14 mm. longae.

NEPAL. Ringmigaon, Phoksumdo Tal, slopes beneath Kanjiroba (lat. 29°. 04′ N., long. 82° 56′ E.) 4,700 m., growing on open slopes; leaves dark green above, phyllaries very dark purple; florets purple; anthers black; stigmas purple; 21st September, 1952. *Polunin, Sykes & Williams* 3534 (holotype in Herb. Brit. Mus.) East of Chalike Pahar (lat. 28° 40′ N., long. 83° 05′ E.), 4,400 m.; grass slopes; leaves glossy; inflorescence purple, 22nd September, 1954, *Stainton, Sykes & Williams* 4540.

Although similar in appearance to *Saussurea superba* forma *pygmaea* Anthony (in *Not. R. Bot. Gard. Edinb.* xviii: 213 (1934)), this new species may be distinguished by its broad outer phyllaries (whence the specific epithet) which are sparsely villous, its sessile or almost sessile capitula with the short scape when present completely hidden in the rosette, and the muricate achenes crowned by a double pappus, the outer hairs of which are slender and feathery, not scabrid, and almost as long as the stouter inner series.

[F. Ludlow]

Dubyaea stebbinsii Ludlow, sp. nov. (Plate 5 and Fig. 7.) (*Compositae*)

Caudex subglobosus, c. 1·5 cm. latus; caulis florifer usque ad 100 cm. altus, striatus, praeter apicem sparse pilosum glaber. *Folia* basalia ignota; folia caulina omnia petiolata, glabra, tenuia, inferiora pinnatipartita segmentis 3–5, superiora simplicia; segmenta lateralia foliorum inferiorum mediorumque elliptica vel obovata, 1–3 cm. longa, 0·5–2 cm. lata; segmentum terminale foliorum inferiorum mediorumque ut superiora simplicia, magnum, triangulare, apice longe cuspidatum vel acuminatum, margine repandum sparse mucroni-denticulatum, basi hastatum vel subcordatum, ad 15 cm. longum et 12 cm. latum; rhachis (vel petiolus foliorum superiorum) 1–7 cm. longa. *Capitula* 1–4, longe pedunculata, cernua, 2·5–4 cm. longa, 4–6 cm. diametro; pedunculus 12–22 cm. longus, superne pubescens, inferne glaber, bractea mediana anguste lanceolata vel lineari 2 cm. longa suffultus; involucrum late campanulatum; phylla imbricata, nigra, praeter marginem interdum ciliatum glabra, quoad formam et magnitudinem valde variabile, exteriora ovata vel anguste ovata 8–10 mm. longa et 3–4 mm. lata, interiora anguste oblonga acuta vel obtusa 13–15 mm. longa et 3–5 mm. lata; *Flores* numerosi; corolla violaceae, purpurea vel rubro-malvina, tubo 6–8 mm. longo, ligula 12–16 mm. longo. *Antherae* 6 mm. longae. Styli rami 2 mm. longi. *Achaenia* (immatura) oblonga, apice truncata, basi angustata c. 8-costata, glabra; pappi setae uniseriatae, rufescentes, scabridae, 8–10 mm. longae.

BHUTAN. Singhi Dzong (lat. 27°. 55′ N., long. 91°. 12′ E.), alt. 3,600 m., 17th August, 1933, *Ludlow & Sherriff* 469. Singhi Dzong, 2,400 m.[1] 4th August, 1949, *Ludlow, Sherriff & Hicks* 21387 (holotype in Herb. Brit. Mus.).

---

[1] This altitude is that of a Lepcha collector and is almost certainly too low. Singhi Dzong is just below the tree line and is about 3,600 m.

S. E. TIBET. Migyitun (lat. 28° 40′ N., long. 93° 38′ E.), alt. 3,750 m., 28th August, 1936, *Ludlow & Sherriff* 2518.

This new species belongs to *Dubyaea* sect. *Dubyaea* (i.e. sect. *Eudubyaea* Stebbins in *Mem. Torr. Bot. Club* xix, **3**: 13 (1940). From the other nine members of this Sino-Himalayan genus it is readily distinguishable by its height—the stems reaching a metre in length—and its compound lower stem-leaves. Unfortunately the basal stem-leaves are unknown, but in its almost glabrous and glaucous habit, its involucre, and its purplish or violet corollas it shows kinship to *D. glaucescens* Stebbins of Western China; in its foliage it perhaps comes nearer *D. rubra* Stebbins, likewise from Western China. Like most other species of *Dubyaea* it is extremely localized in its distribution. Although Bhutan and south-east Tibet have been fairly well worked in recent years it is known only from two gatherings in the former country (both from the same locality) in 1933 and 1949, and from one in the latter country in 1936. The Bhutanese plants from Singhi Dzong were growing in woodland shade, whilst the Tibetan plants from Migyitun (150 miles east of Singhi Dzong) were found on open grassy alpine slopes. Both these localities are subject to a very heavy rainfall.

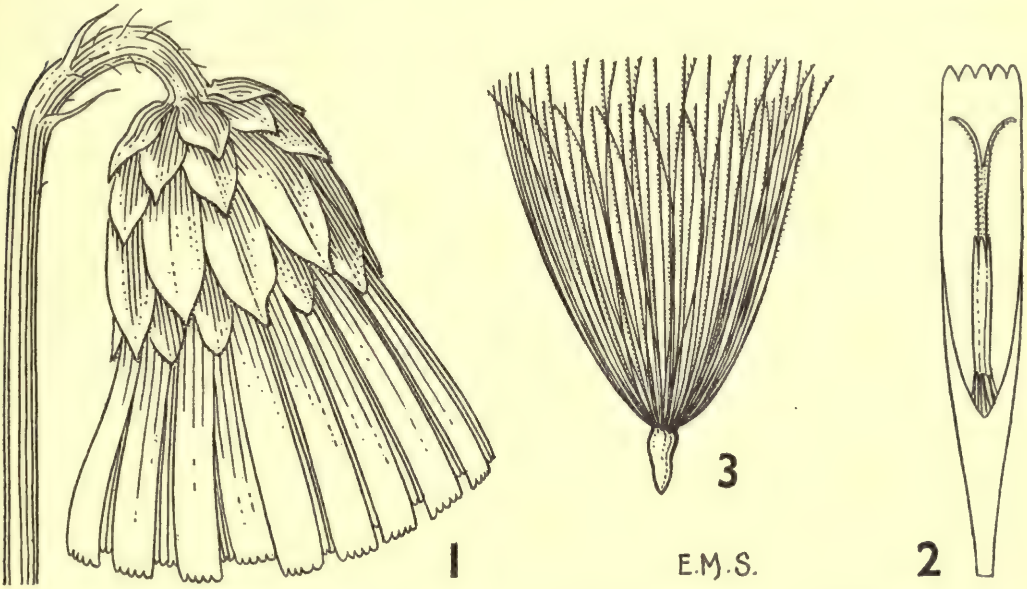


FIG. 7.—*Dubyaea stebbinsii* Ludlow. 1. Capitulum (× 2). 2. Corolla (× 3). 3. Achene and pappus (× 6).

I have named this species in honour of Professor Ledyard Stebbins of the University of California, whose monographic work on *Dubyaea*, *Soroseris* and other genera of *Cichorieae* has so greatly clarified their taxonomy.

[F. Ludlow]

Androsace ciliifolia Ludlow, sp. nov. (Fig. 8.) (*Primulaceae*)

Herba densecaespitosa, pulvinos e ramis numerosis aggregatis compositos formans; caules (surculi) columnares, infra rosulam terminalem foliorum vivorum foliis mortuis brunneis dense vestiti. *Folia* permulta, sessilia, imbricata, anguste oblonga vel oblongo-lanceolata, apice obtusa vel rotundata, 3–4 mm. longa, 1–1·75 mm. lata, margine pilis albis ciliata, ceterum glabra. *Scapus* nullus vel 3 mm. tantum longus; flores solitarii vel raro gemini, plerumque 5-meri, interdum 4- vel 6-meri. *Calyx* 2–3 mm. longus, ad medium in segmenta oblonga c. 0·8–1 mm. lata trinervia apice rotundata praeter marginem ciliatum glabra fissus. *Corolla* alba, oculo aurantiaco vel rubro, limbo 4–5 mm. lato, lobis latissime obovatis vel obcuneiformibus rotundatis. *Ovarium* turbinatum.

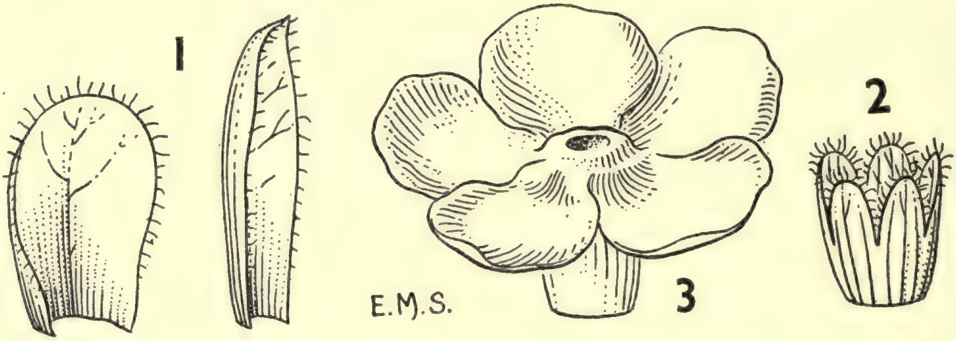


FIG. 8.—*Androsace ciliifolia* Ludlow. 1. Leaves (× 10). 2. Calyx (× 10). 3. Corolla (× 10).

S. E. TIBET. Sang La, Kongbo (lat. 29° 36′ N., long. 94° 51′ E.), alt. 4,420 m.; forming large cushions on steep grassy slopes; perianth white with orange or occasionally crimson eye, 27th May, 1938, *Ludlow, Sherriff & Taylor* 5029 (holotype in Herb. Brit. Mus.).

This is distinguished from *Androsace selago* Hook. & Thoms. and *A. tapete* Maxim., its nearest relatives in the Section *Aretia*, by its non-villous, ciliate-margined leaves and calyx, and also by the prominent venation of the latter.

[F. Ludlow]

Androsace hemisphaerica Ludlow, sp. nov. (Fig. 9.) (*Primulaceae*)

Herba dense caespitosa, pulvinos hemisphaericos 8–14 cm. diametro e ramis numerosis aggregatis compositas formans; caules (surculi) columnares, infra rosulam terminalem foliorum vivorum argenteorum residuis atris mortuis dense vestiti. *Folia* permulta, sessilia, imbricata, plerumque oblanceolata interdum anguste ovata vel oblongo-lanceolata, apice obtusa, 3–5 mm. longa, 1–1·75 mm. lata, dimidio inferiore hyalino subglabro, dimidio superiore viridi pilis longis villoso, venis obscuris. *Scapus* nullus vel brevissimus; flores solitarii, plerumque 5-meri, interdum 6-, 7- vel etiam 8-meri. *Calyx* 3–4 mm. longus, fere ad basim in segmenta anguste lanceolata 0·7–1 mm. lata trinervia sericea fissus. *Corolla* rosea, oculo

flavo, limbo 8–10 mm. lato, lobis latissime obovatis rotundatis. *Ovarium* turbinatum, 1·5 mm. diametro ; stylus 1 mm. longus, stigmate vix incrassato.

BHUTAN. Marlung, Tsampa, Bumthang Chu (lat. 27° 56′ N., long. 90° 37′ E.), alt. 4,725 m. ; in sandy scree ; a fine cushion plant ; foliage silvery ; corolla rich rose to pink, eye yellow ; 11th July, 1949, *Ludlow, Sherriff & Hicks* 19404 (holotype in Herb. Brit. Mus.). Waitang, Tsampa, Bumthang Chu (lat. 27° 57′ N., long. 90° 45′ E.), alt. 4,725 m ; on open grassy slopes ; corolla rich rose ; foliage silvery, 22nd June, 1949, *Ludlow, Sherriff & Hicks* 19217. Waitang, Tsampa, Bumthang Chu, alt. 4,572 m., corolla rich rose or purple with a yellow eye, 25th June, 1949, *Ludlow, Sherriff & Hicks* 19243. Gafoola, Upper Mangde Chu (lat. 27° 57′ N., long. 90° 15′ E.), alt. 4,420 m ; corolla rose pink with a yellow eye, 10th July, 1949, *Ludlow, Sherriff & Hicks* 16788.

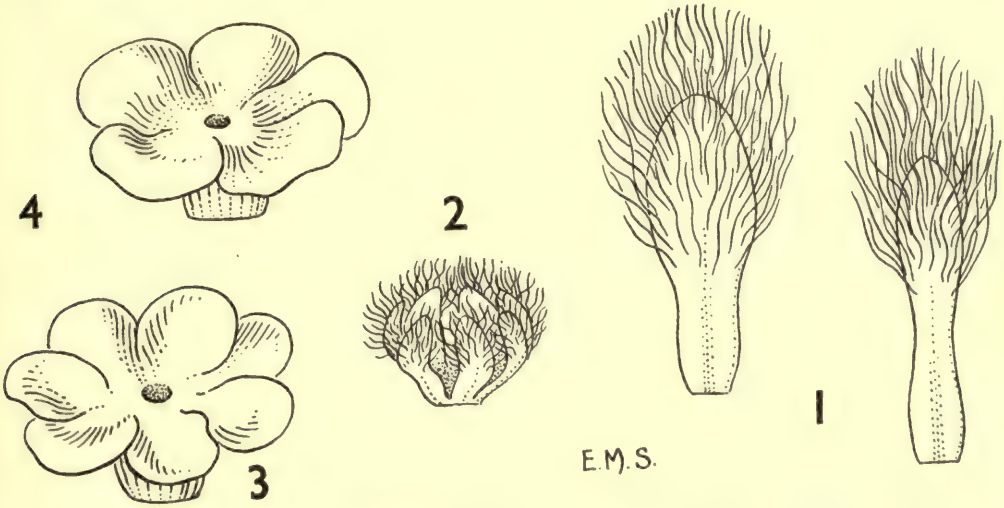


FIG. 9.—*Androsace hemisphaerica* Ludlow. 1. Leaves (× 8). 2. Calyx (× 4). 3. Corolla (× 4). 4. Corolla (× 4).

This is an extremely handsome cushion plant growing at great heights and confined, as far as is known at present, to the alps of central Bhutan. Its nearest ally seems to be *A. selago* Hook. f. & Thoms. from which it is at once distinguished by its rose-red flowers and silvery foliage.

A reference to this plant and a habitat photograph occur in the *Journal of the Royal Horticultural Society* lxxvii ; 238, fig. 104 (1952).

[F. Ludlow]

Daphne macrantha Ludlow, sp. nov. (Plate 6 and Fig. 10.) (*Thymelaeaceae*)

Fruticulus c. 30 cm. altus procumbens dichotome ramosus, ramulis angulatis glabris atro-brunneis cicatricibus semilunatis pallidis. *Folia* alterna, ad ramulorum apices conferta, ut videtur sempervirentia, plerumque anguste obovata, apice obtusa interdum retusa, margine revoluta, basi cuneata in petiolum c. 1–2 mm. longum

contracta, 3–5·5 cm. longa, 1·5–2·5 cm. lata, glabra, coriacea, venis supra impressis subtus prominulis. *Capitula* terminalia, subsessilia, bracteata, 4–10-flora ; bracteae caducae, oblongae vel oblongo-ovatae c. 10–15 mm. longae, 5–7 mm. latae ; pedicelli villosi, c. 1–2 mm. longi. *Flores* albi, magni, odori, tetrameri. *Perianthium* extus pilosulum, intus glabrum ; tubus c. 1·2–1·7 cm. longus ; lobi ovati vel late ovati, obtusi, interdum retusi, 12–13 mm. longi, 7–10 mm. lati. *Stamina* 8, inclusa ; antherae anguste oblongae, c. 2 mm. longae ; filamenta c. 0·5 mm. longa. *Disci* squama unica, c. 0·6–1 mm. alta. *Ovarium* ellipsoideum breviter stipitatum, glabrum, stylo brevi, stigmate capitato.

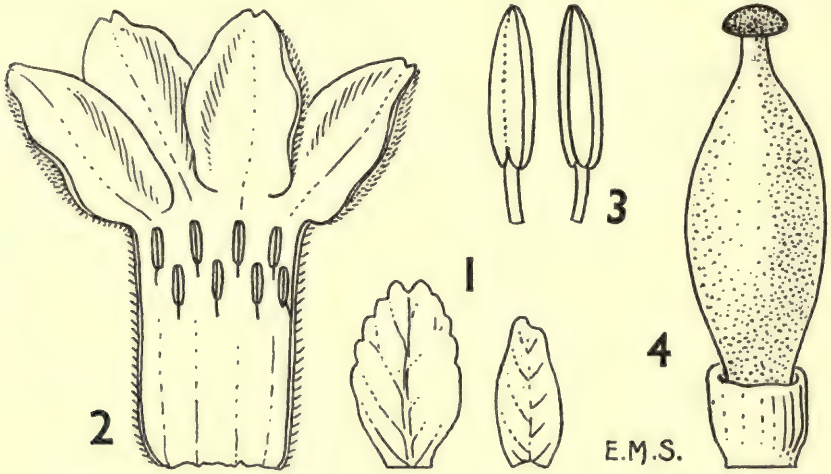


FIG. 10.—*Daphne macrantha* Ludlow. 1. Bracts (× 2). 2. Corolla opened out (× 2). 3. Stamens (× 10). 4. Ovary (× 10).

S.E. TIBET. Tsari Sama, Langong (lat. 28° 45′ N., long. 94° E.) ; alt. 4,260 m., growing only in one place, beside rocks on open hillside, north face, prostrate shrub 1ft. long ; corolla fleshy, cream white slightly yellow in the eye, very fragrant ; leaves dull green above, veins deeply indented, pale below ; wood soft and pliable ; 16th June, 1938, *Ludlow, Sherriff & Taylor* 5585 (holotype in Herb. Brit. Mus.).

This semi-prostrate shrub of the high alpine zone in S.E. Tibet, belongs to *Daphne* sect. *Daphnanthes* C. A Mey. which is characterized by the flowers being arranged in capitate terminal inflorescences. It bears a superficial resemblance to the European *D. blagayana* Freyer, a member of the same section, but its flowers are larger than those of any other member of the genus, being 2·5–3·5 cm. in diameter. The plant is apparently rare in south-eastern Tibet and was found in only one locality. Unfortunately no fruit could be obtained so that the introduction of this beautiful species to gardens was not possible.

[F. Ludlow]

Lilium paradoxum Stearn, sp. nov. (Plate 7.) (*Liliaceae*)

Bulbus parvus, c. 1·5–2·5 cm. longus, 1–2·5 cm. latus ; squamae ovate, acutae vel breve acuminatae, usque ad 2·5 cm. longae, 8 mm. late ; caulis erectus, 20–45 cm.

altus, papillosus, basi radicans, e basi per 4–20 cm. nudus, deinde cataphyllis 1–2, tum foliis 2–4 brevibus remotis, postremo in parte media et supera verticillis foliorum usque 8–foliatis 2–4 inter se 2–5 cm. distantibus vestitus, flore solitario terminatus. *Folia* verticillaria media elliptica, usque ad 3·5 cm. longa, 1·5 cm. lata ; verticillaria suprema oblanceolata, usque ad 3 cm. longa, 9 mm. lata ; omnia apice acuta, basi cuneata, glabra, margine et nerviis in pagina superiore scabridulis. *Pedunculus* 2–5·5 cm. longus, glaber. *Flos* ut videtur erectus et apertus, purpureus, immaculatus, 5·5–7 cm. latus ; perianthii segmenta anguste elliptica vel raro anguste ovata, integra, acuta, c. 2·5–3·5 cm. longa, 1–1·4 cm. lata, ad basim per 7 mm. atropurpurea plana ecristata glabra. *Stamina* erecta ; filamenta c. 1·6 cm. longa, glabra, e basi 1·5 mm. lata in apicem filiformem c. 5–3 mm. longum sensim attenuata ; antherae lineares, post dehiscentiam 6–8 mm. longae, versatiles. *Ovarium* c. 6–8 mm. longum ; stylus clavatus, c. 1·7 cm. longus, glaber ; stigma capitatum, c. 6 mm. latum.

S.E. TIBET. Near Showa Dzong, Pome (lat. 29° 55′ N., long. 95° 25′ E.), alt. 3,600 m. perianth same colour as *Nomocharis soulei* ; 9th June 1947, *Ludlow, Sherriff & Elliot* 13114 (holotype in Herb. Brit. Mus.)

This species connects *Lilium* and *Nomocharis* as redefined by Sealy in *Kew Bull.* 1950 : 273 *et seq.* (1950) and can with almost equal propriety be placed in either. No information is available about the poise of the flower in the living state, but it appears from dried material to be erect with the perianth-segments spreading from the base as in *Nomocharis*. All six segments are, however, entire and essentially the same ; the basal area is equally dark on the inner and outer segments and without crests or swellings ; although the thickening of the nerves gives the base a slightly ridged appearance, there are no well-marked nectarial furrows. The colour was described in the field as like that of *Lilium souliei* (Franch.) Sealy, which is dark purplish-red. The flattened filaments narrow gradually from the base and are purple except for the paler filiform tip. The combination of whorled leaves, one-flowered habit, and purple entire unspotted perianth-segments all equally stained at the base sets this species apart from all species described under *Lilium* and *Nomocharis*.

[W. T. Stearn]

Paris marmorata Stearn, sp. nov. (Plate 8 and Fig. 11.) (*Liliaceae*)

Herba perennis, glabra, 7–18 cm. alta ; rhizoma abbreviatum, c. 8 mm. crassum. *Folia* 5–6 in verticillum disposita, fere sessilia, lanceolata vel anguste lanceolata, apice acuminata, basi in petiolum vix 2 mm. longum angustata, c. 5·5–6·5 cm, longa, 1·4–2·1 cm. lata, supra atro-viridia vittis pallide viridibus vel etiam albidis secus venas currentibus longitudinaliter et plus minusve transverse notata infra purpureo-brunnea. *Pedunculus* 7–20 mm. longus. *Perianthii* segmenta exteriora 3–4, sessilia, anguste lanceolata, acuminata, 20–30 mm. longa, 5–10 mm. lata, ut folia viridia variegataque ; interiora filiformia, c. 17–22 mm. longa, 0–5 mm. lata, superne purpurea, inferne viridia. *Stamina* 6–8, perianthii segmentis multo breviora, erecta, c. 5–7 mm. longa ; antherae obtusae, post dehiscentiam c. 1·5 mm. longae, connectivo supra loculos non producto, polline flavo. *Ovarium*

subglobosum, viride, c. 3 mm. longum, 3·5 mm. latum ; styli c. 1–1·5 mm. longi, atro-purpurei.

BHUTAN. Drugye Dzong (lat. 27° 30′ N., long. 89° 19′ E.), alt. 2,850 m.; leaves dark green, veins pale green ; outer perianth whorl (or bracts) green and leaf-like ; inner whorl filamentous, green at base and purplish at apex ; stamens yellow brown ; ovary green, style and stigma dark purple. 12th May, 1949, *Ludlow, Sherriff & Hicks* 16213.

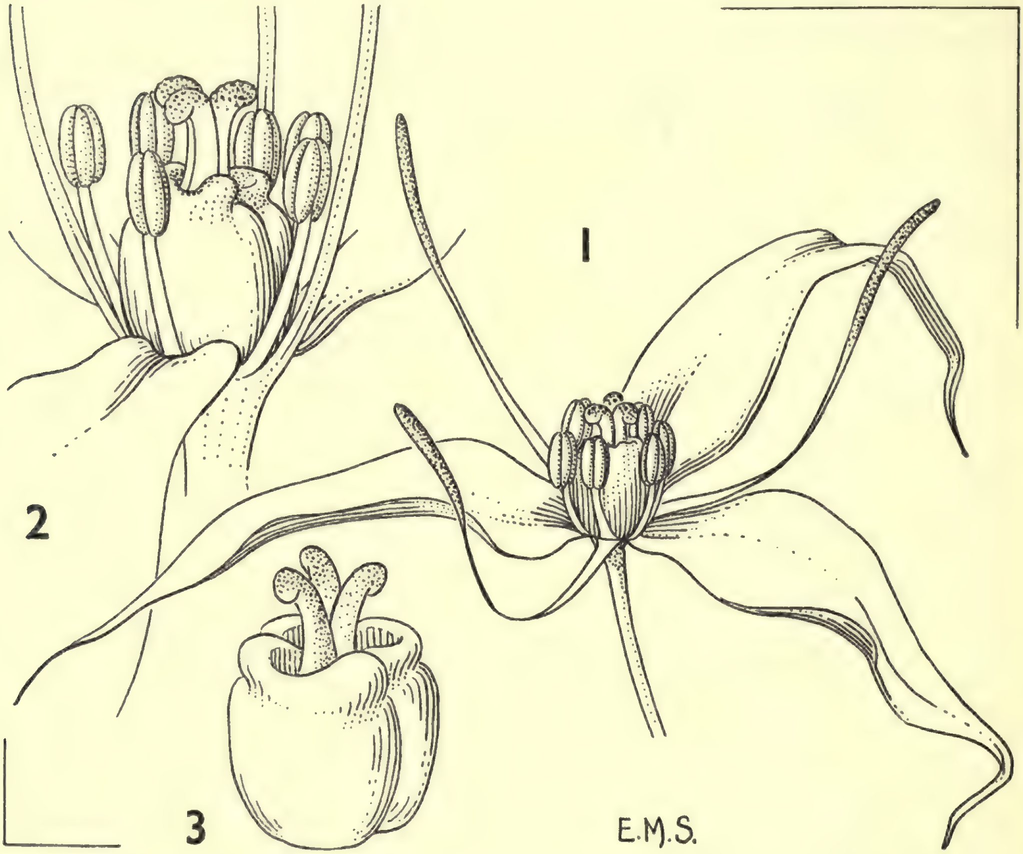


FIG. 11.—*Paris marmorata* Stearn. 1. Flower (× 3). 2. Part of flower (× 6). 3. Ovary and style (× 6).

S.E. TIBET. Between Kumang and Nyuksang (Tsangpo Gorge) (lat. 29° 45′ N., long. 95° 00′ E.), alt. 2,700 m.; growing in bamboo growth ; under surface of leaves purplish brown ; upper surface dark green broadly veined white ; perianth dark brown ; filaments pinkish, anthers yellow ; ovary green, stigma disk purple, 28th April, 1947, *Ludlow, Sherriff & Elliot* 13564 (holotype in Herb. Brit. Mus.).

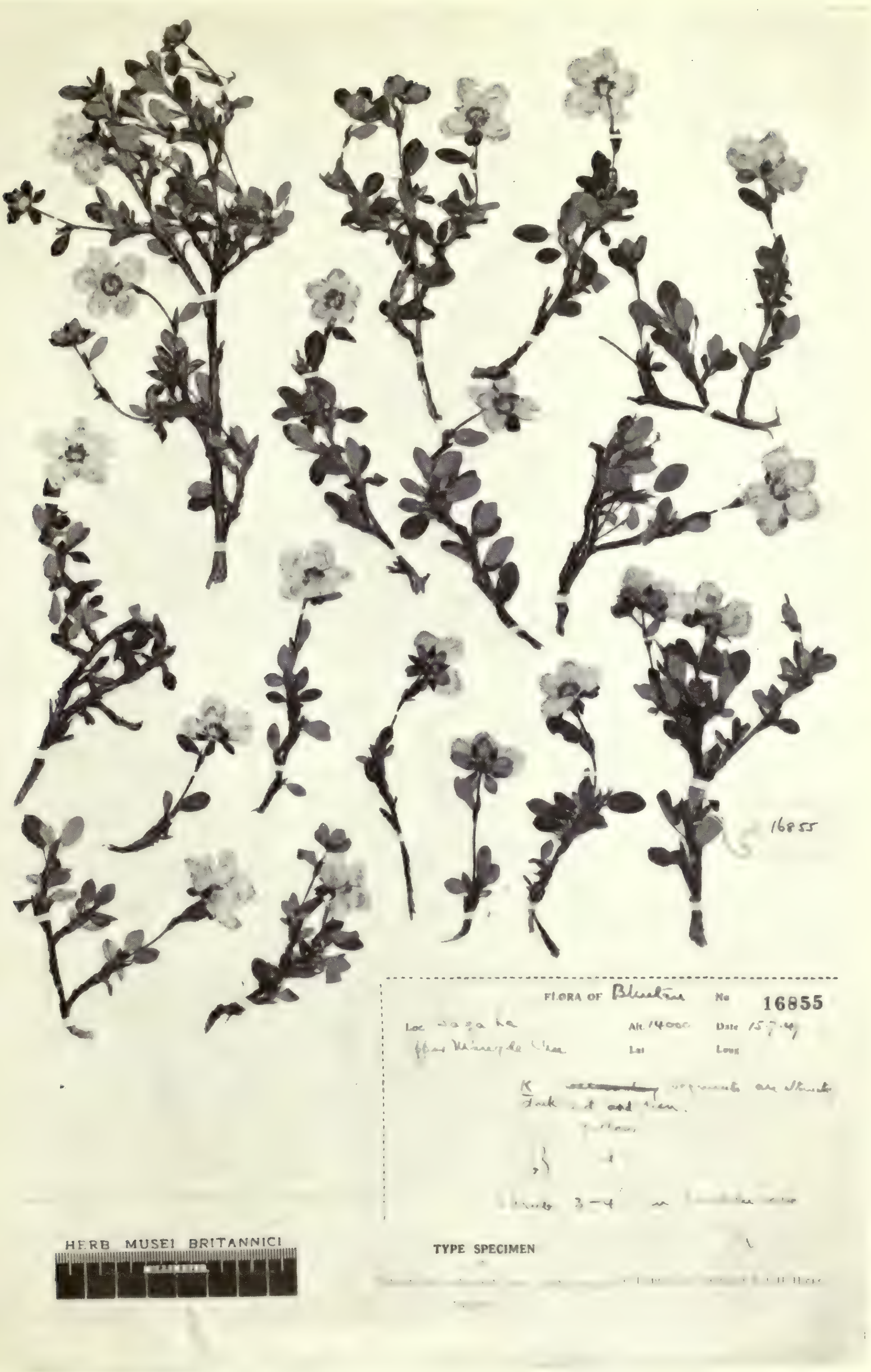
On account of its short styles this species may be placed in the Section *Euthyra* Franch. (in *Mém. Soc. Philom. Cent. Fond. Paris*: 277 (1888)) next to *Paris* *polyphylla* Sm., the outer perianth-segments being leaf-like, the stamens only up to 10, and the connective not produced above the anther-loculi, but *P. polyphylla* is usually a much more robust plant having distinctly petiolate leaves, larger outer perianth-segments and longer inner segments. The most distinctive feature of *P. marmorata* lies in the contrast between the general dark green colour of the leaves and outer perianth-segments and the paler green or whitish bands running along the veins.

[W. T. Stearn]

BRITISH MU

PLATE 1

Potentilla arbuscula var. *unifoliolata* Ludlow.

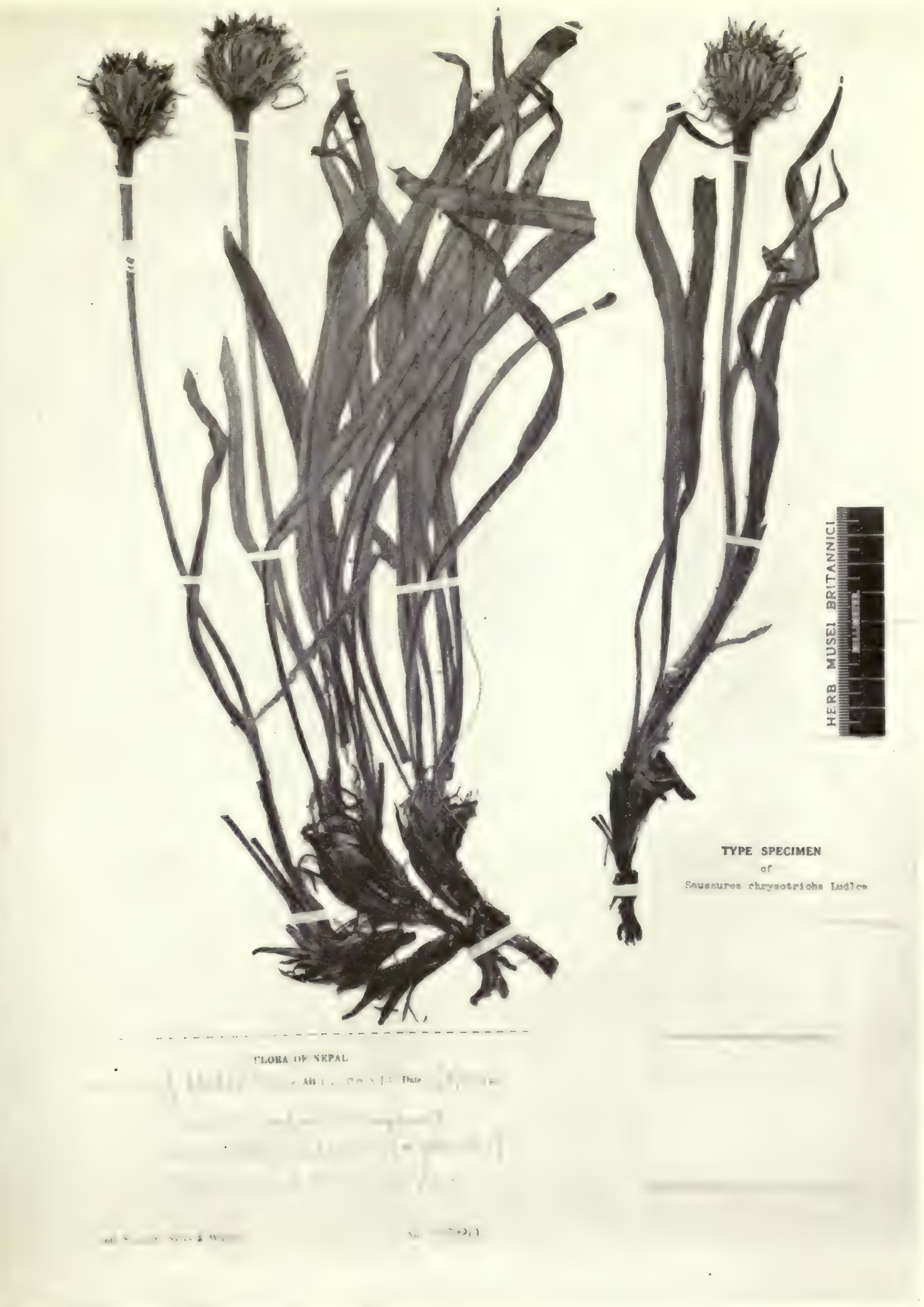

16855
FLORA OF Bhutan
No 16855
Loc
Alt. 14000
Date 15.7.49
Lat
Long
HERB MUSEI BRITANNICI
TYPE SPECIMEN

Type specimen of *Potentilla arbuscula* var *unifoliolata* Ludlow

PLATE 2

Saussurea chrysotricha Ludlow.

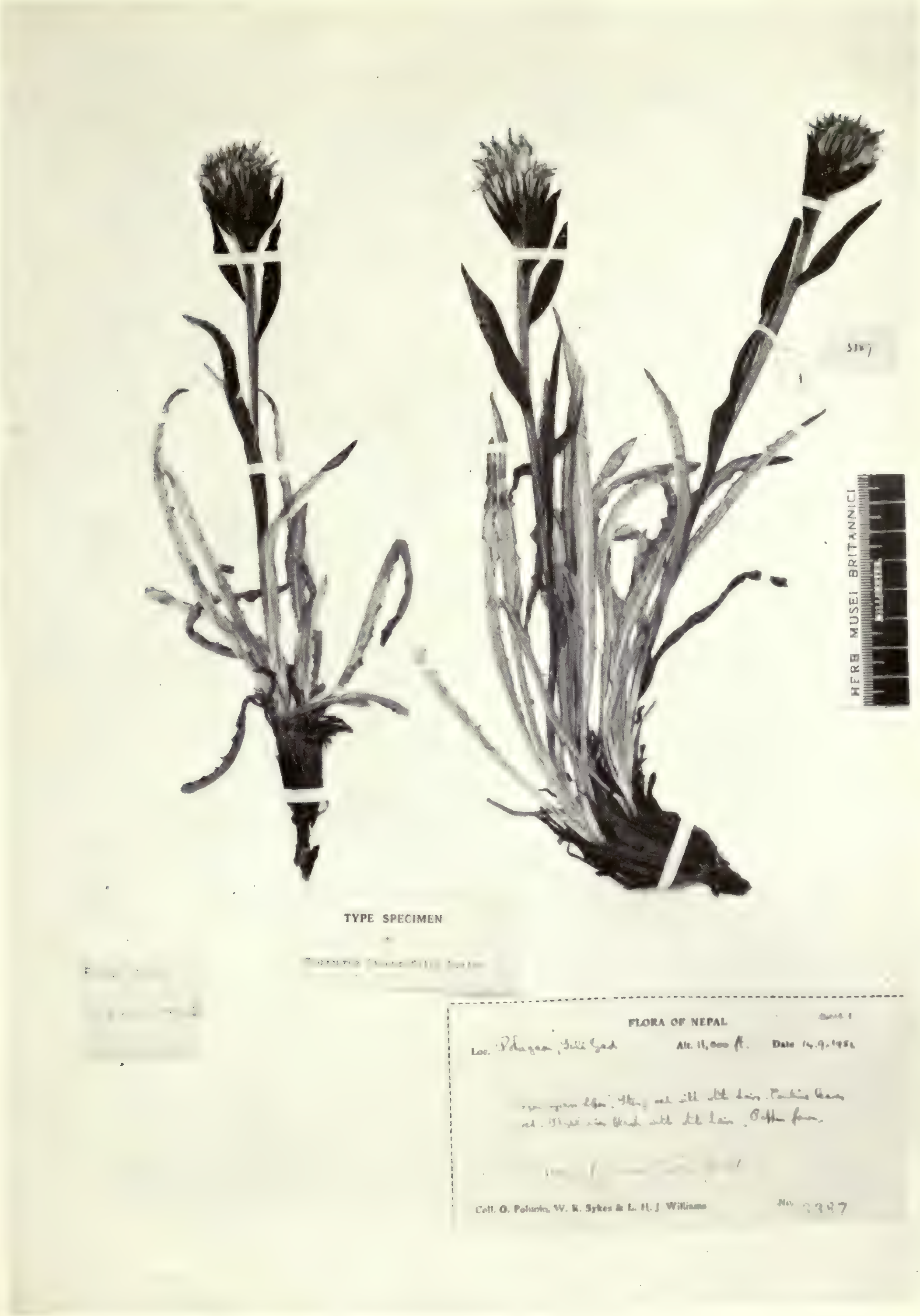
PLATE 2


HERB MUSEI BRITANNICI
TYPE SPECIMEN
of
Saussurea chrysotricha Ludlow
FLORA OF NEPAL

Type specimen of *Saussurea chrysotricha* Ludlow

PLATE 3

Saussurea linearifolia Ludlow.



TYPE SPECIMEN

FLORA OF NEPAL

Loc. Phuzgaon, Sulli Gad Alt. 11,000 ft. Date 14.9.1952

[illegible]

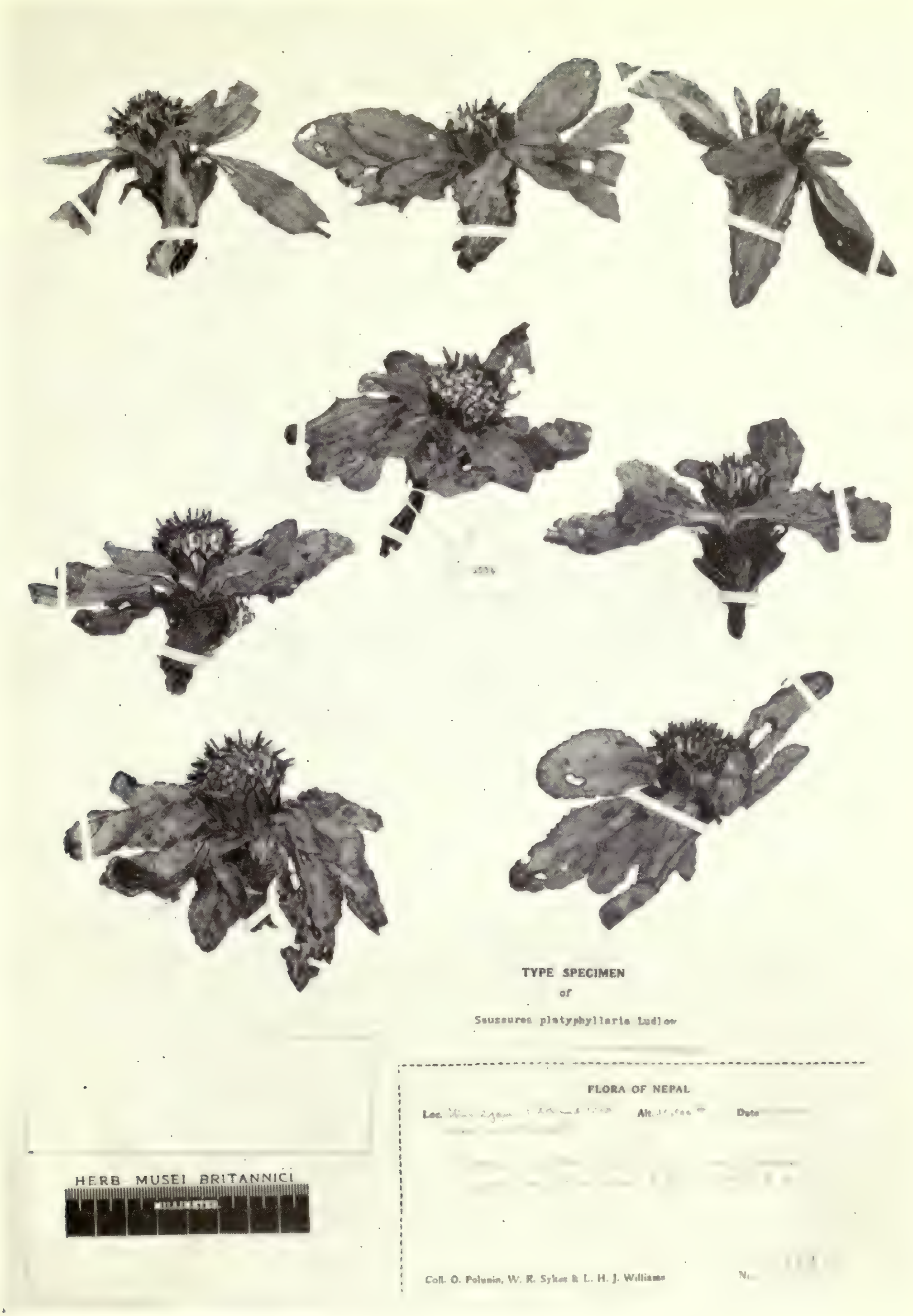
Coll. O. Polunin, W. R. Sykes & L. H. J. Williams No. 3387

HERB. MUSEI BRITANNICI

Type specimen of *Saussurea linearifolia* Ludlow

PLATE 4

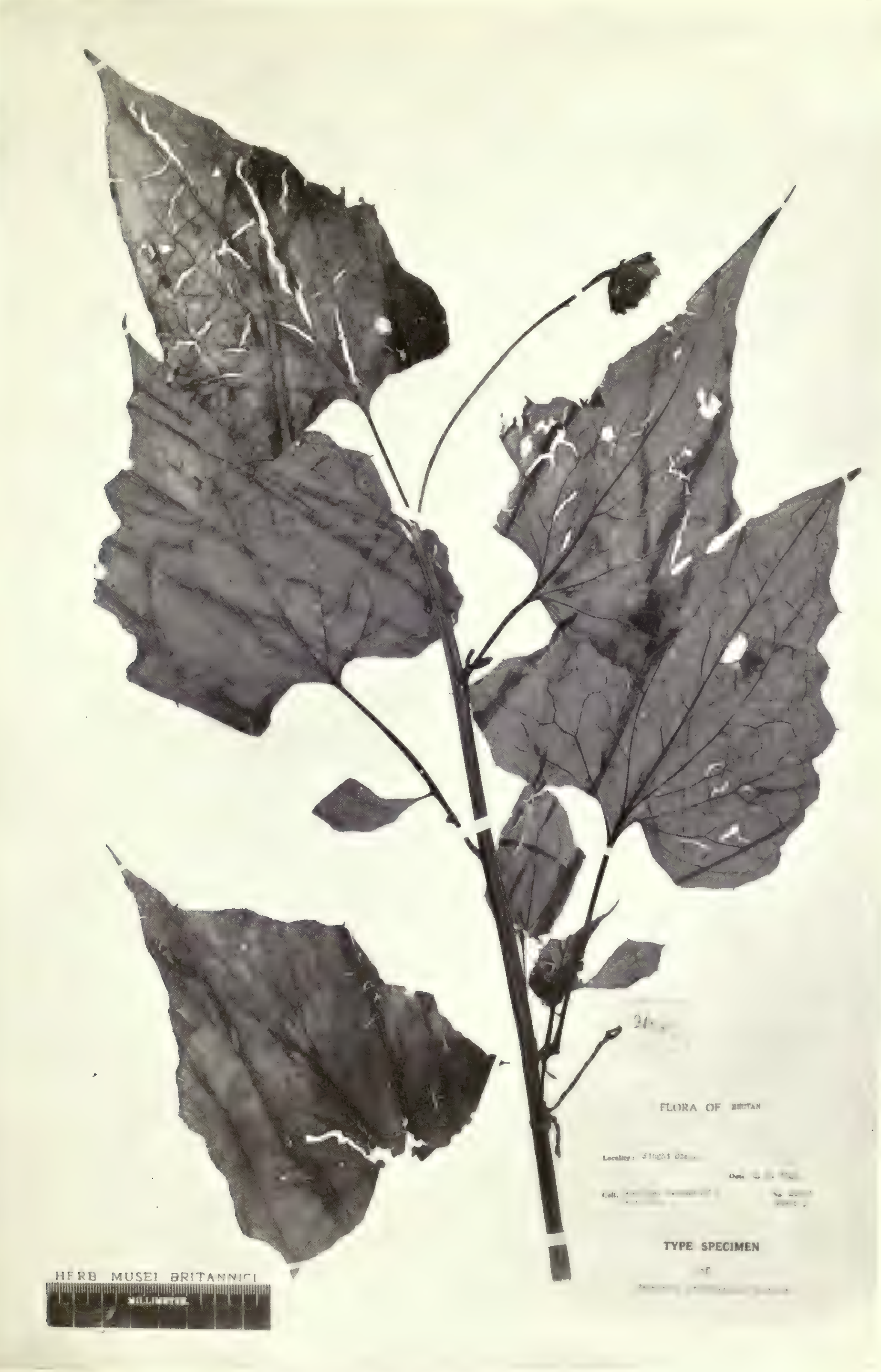
Saussurea platyphyllaria Ludlow.


TYPE SPECIMEN
of
Saussurea platyphyllaria Ludlow
FLORA OF NEPAL
Loc.
Alt.
Date
Coll. O. Polunin, W. R. Sykes & L. H. J. Williams
No.
HERB MUSEI BRITANNICI
MILLIMETRES

Type specimen of *Saussurea platyphyllaria* Ludlow

PLATE 5

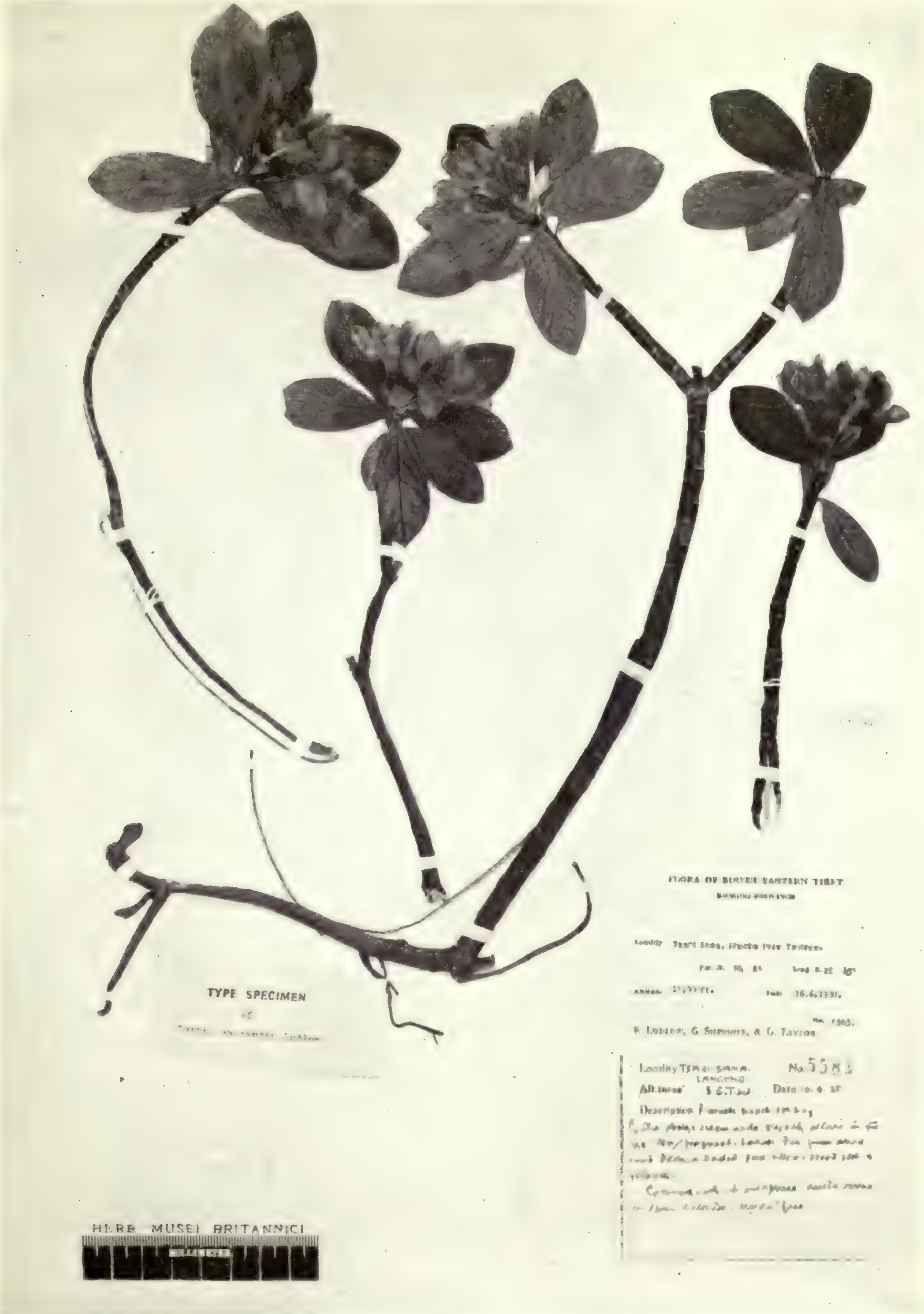
Dubyaea stebbinsii Ludlow.


FLORA OF BHUTAN
Locality:
Date
Coll.
No.
TYPE SPECIMEN
of
HERB. MUSEI BRITANNICI
MILLIMETER

Type specimen of *Dubyaea stebbinsii* Ludlow

PLATE 6

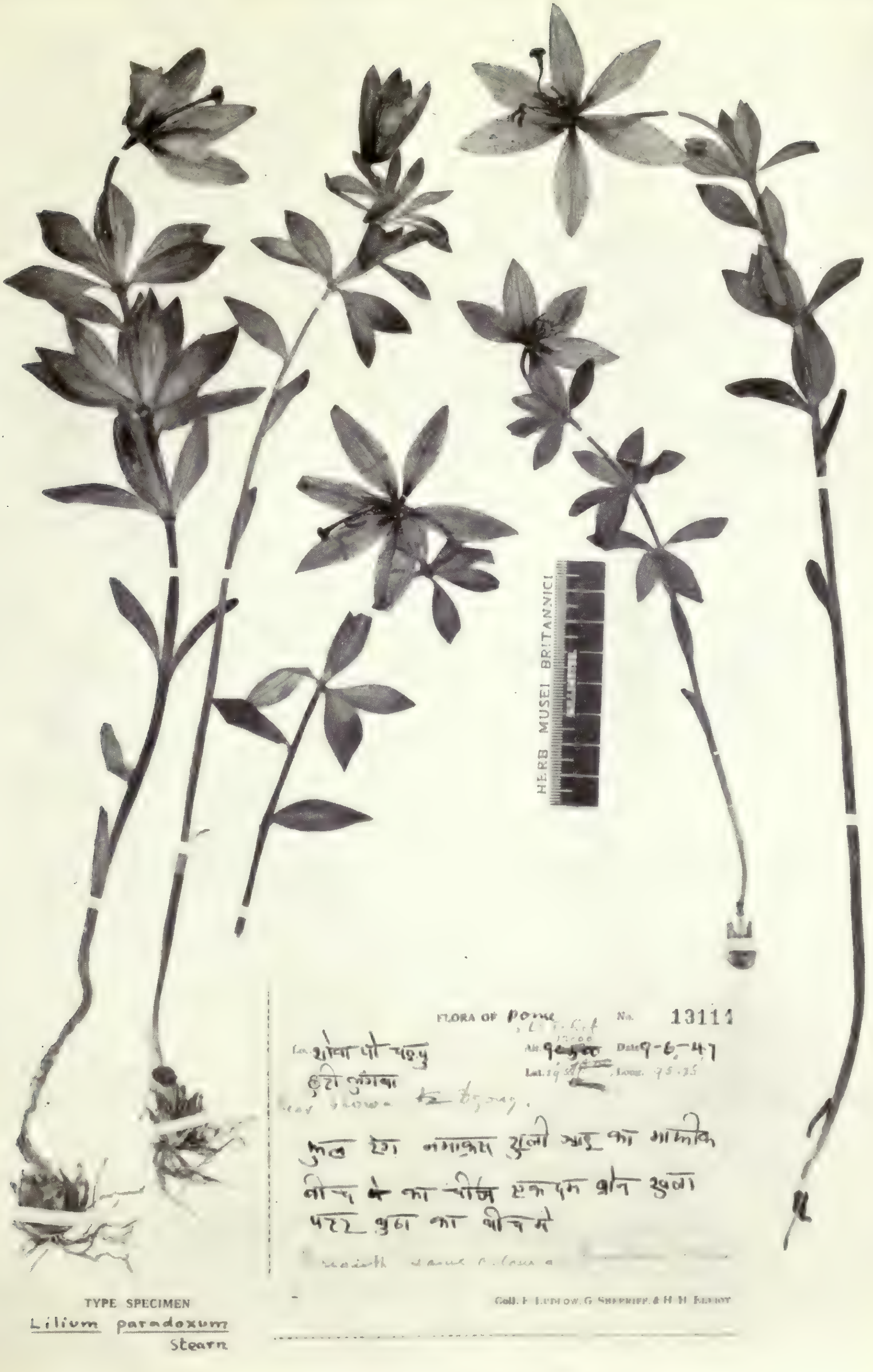
Daphne macrantha Ludlow.


TYPE SPECIMEN
HERB. MUSEI BRITANNICI

Type specimen of *Daphne macrantha* Ludlow

PLATE 7

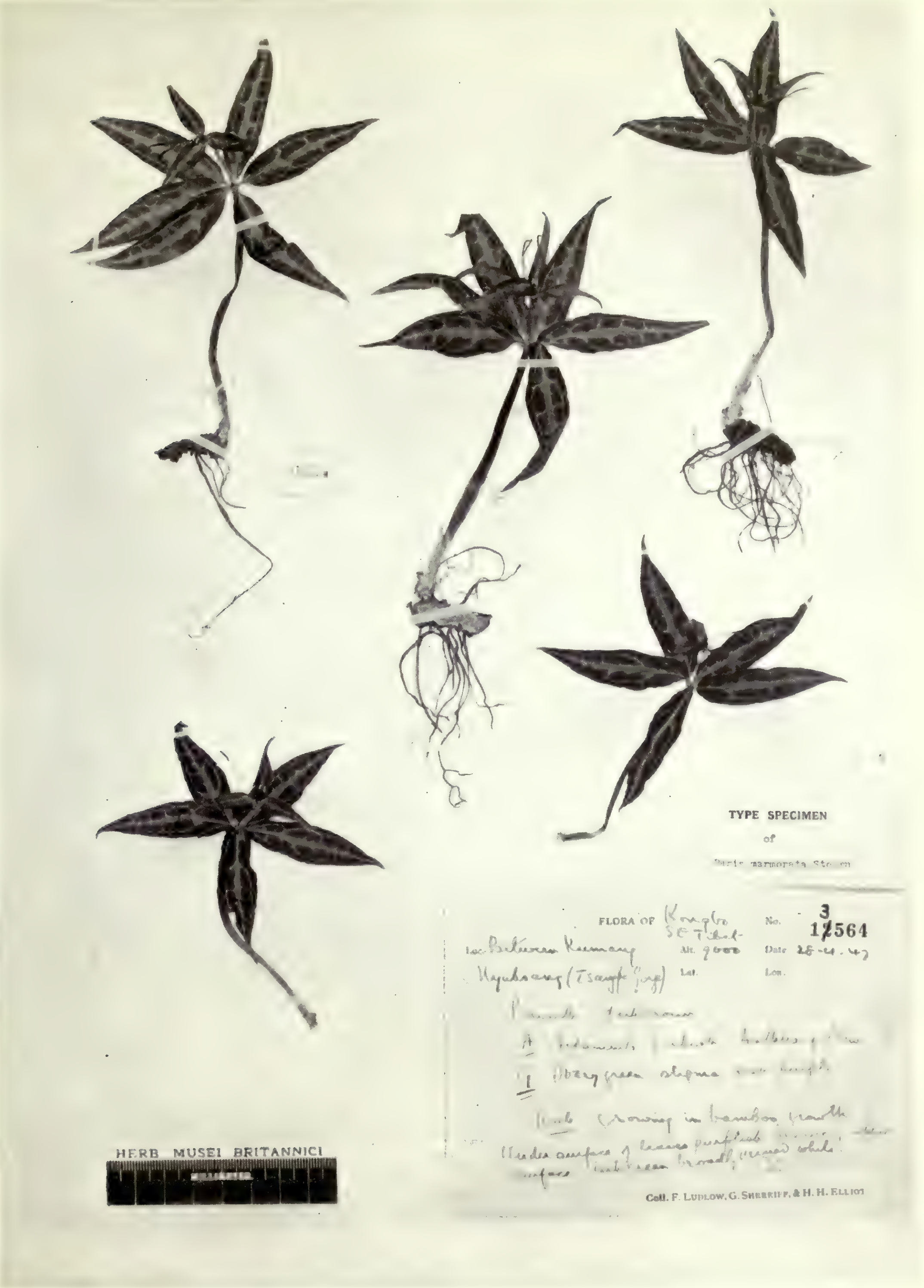
Lilium paradoxum Stearn.


HERB MUSEI BRITANNICI
FLORA OF Pome
No. 13114
Date 9-6-47
Coll. F. Ludlow, G. Sherriff & H. H. Elliot
TYPE SPECIMEN
Lilium paradoxum
Stearn

Type specimen of *Lilium paradoxum* Stearn

PLATE 8

Paris marmorata Stearn.


HERB. MUSEI BRITANNICI
TYPE SPECIMEN
of
Paris marmorata Stearn
FLORA OF Kongbo SE Tibet
No. ~~12564~~ 13564
Loc. Between Keumang
Nyuksang (Tsangpo Gorge)
Alt. 9000
Date 28-4-47
Lat.
Lon.
Growing in bamboo growth
Under surface of leaves purplish
Coll. F. Ludlow, G. Sherriff, & H. H. Elliot

Type specimen of *Paris marmorata* Stearn

BRITISH MUSEUM
[illegible] OCT 1956
NATURAL HISTORY

SAXIFRAGA OF THE HIMALAYA

I. SECTION *KABSCHIA*

HARRY SMITH

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 4
LONDON : 1958

SAXIFRAGA OF THE HIMALAYA

I. SECTION *KABSCHIA*

BY

HARRY SMITH xnf

(Uppsala)

Pp. 83–129 ; 14 *Text-figures*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 4
LONDON : 1958

THE BULLETIN OF THE BRITISH MUSE
(NATURAL HISTORY), *instituted in* 1949,
*issued in five series corresponding to the Departme
of the Museum, and an Historical Series.*

*Parts appear at irregular intervals as they bec
ready. Volumes will contain about three or f
hundred pages, and will not necessarily be comple
within one calendar year.*

This paper is Vol. 2, No. 4 of the Botany series

BRITISH MUSEUM
20 MAR 1958
NATURAL HISTORY

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued March, 1958 *Price Fifteen Shillings*

SAXIFRAGA OF THE HIMALAYA

I. SECTION *KABSCHIA*

By HARRY SMITH

THE material of *Saxifraga* sect. *Kabschia* brought home from unexplored parts of the Himalaya by recent British Museum expeditions is embarrassing in its richness. Not only has it increased the number of recognized species from 10 to 41, but some of the new species, and in two cases whole groups of them, represent types of Kabschias previously unknown. It would not have been possible for me to name these collections if I had not received the loan of much herbarium material from the Royal Botanic Gardens at Kew and Edinburgh and the Department of Botany at the British Museum (Natural History). I desire to express my most sincere thanks to the Keepers of these Institutions for their ever-ready help, and for their patient forbearance in allowing me to retain these loans for so lengthy a period.

Especially remarkable is the group formed by the three closely related species *S. brevicaulis* (Lhasa region), *S. sessiliflora* (S.E. Tibet) and *S. williamsii* (Nepal). They are distinguished by thin, fairly herbaceous leaves, destitute of the calcium-secreting pores which otherwise are never-failing characteristics of the section. A peculiar feature is also the persistent petals, which often remain on the ripe fruit in an almost undamaged state.

New also is a group with solitary yellow flowers comprising five species, namely *S. buceras*, *S. elliotii*, *S. kongboensis*, *S. nambulana* (all from S.E. Tibet), and *S. thiantha* (Bhutan).

The following three species occupy a quite isolated position, without traceable connexions with any other: *S. ludlowii* (S.E. Tibet) with solitary pink flowers, bigger than in any other Kabschia; *S. lowndesii* (Nepal) with " flowers brilliant rose-lilac ", in appearance much resembling *S. oppositifolia* L.; *S. flavida* (Bhutan), a rather inconspicuous plant, but remarkable by being the only yellow-flowered species with glands in the margin of the leaves.

The important finds among the group with decussate leaves will be discussed below.

Engler and Irmscher divided the Kabschias into seven more or less natural groups. This arrangement is based mainly on the rich and intensely studied material from the Mediterranean-Asia Minor areas. Less attention was paid to the Himalayan elements, of which only 11 species were known at that time (against 28 from Europe and Western Asia). A study of this material indicates that the Engler and Irmscher scheme is satisfactory only for a few of the Himalayan forms and is unsuited to the abundant material available to-day. For this reason, the enumeration below will not follow their arrangement of the section. The species will be mentioned in the same order as they appear in the determination key.

Engler based his new section *Tetrameridium* on the single species *S. nana* Engler, discovered by Przewalsky in Kansu in 1880 (Bull. Acad. Imp. Sci. St.-Pétersb. xxix : 118 (1883)). He described the plant as " valde singularis ", and remarked : " Etiamsi petala invenirentur, haec sectio approbari debet, quum floribus tetrameris et foliis tenuibus haud calcem secernentibus a sectio *Calliphyllum* differt".

It is significant that Engler compared his new section only with section *Calliphyllum* (now known as *Porphyrion*). No mention of *Kabschia* was made. This is quite natural as at that time no decussate-leaved Kabschia was known and Engler had no reason to suspect affinity outside the likewise decussate *Porphyrion*.

It was 36 years later that the first Kabschia with decussate leaves was described : *S. quadrifaria* Engler & Irmscher in Engler, Pflanzenr. IV. 117 : 575 (1919). About the taxonomic position of the species it was said : " Habitu et foliis oppositis ad sectionem *Porphyrion* accedit, differt autem foliis omnino glabris. Etiam partium floralium proportiones speciem valde insignem locum juxta Saxifragas marginatas [i.e. subsection *Marginatae* of *Kabschia*] habere demonstrant ". It is very surprising that here no reference was made to section *Tetrameridium*.

In later years three other species with decussate leaves have been described. Two of them are tetramerous (*S. octandra* H. Sm. and *S. decussata* Anthony), both referred by their authors to *Tetrameridium*, and one pentamerous (*S. georgei* Anthony), which was placed in *Kabschia*. The new Himalayan material recently received includes no fewer than five new species (described below) of this kind, and has proved also that the interesting *S. georgei*—previously only known from western Yunnan—occurs in S.E. Tibet and is fairly common in Nepal and Bhutan. In this rich material of the pentamerous *S. georgei*, a good many tetramerous flowers were found, especially in dwarfed specimens. Now, *S. decussata* and *S. georgei* look very similar : sterile plants can only with great difficulty be kept apart, and in fact one might be tempted to regard *S. decussata* as a reduced tetramerous race of *S. georgei*. In any case their close affinity cannot be doubted, and their placing in different sections is absurd.

Bearing in mind that Engler delimited *Tetrameridium* from *Porphyrion* only, it is not surprising that of the distinctions he indicated only one can serve the purpose against *Kabschia*, i.e. the tetramerous flowers. All the tetramerous species, except *S. nana*, are provided with petals, *S. monantha* with very conspicuous ones. All of them, even *S. nana*, have calcium-secreting pores. In their general appearance, as well as in their detailed structure, the tetramerous and pentamerous species are very similar. They are undoubtedly of close affinity and there is no valid reason for the retention of *Tetrameridium* as an independent section.

The important feature is the opposite amplexicaul leaves ; the number of the floral organs is of secondary importance. The decussate-leaved species, both tetramerous and pentamerous, constitute a group of their own, diverse from other species of *Kabschia*. But, unfortunately, the group is not homogeneous. The two opposite leaves of a pair are connected basally in two different ways. Either the leaves are so completely connate that their margins form an unbroken line (see fig. 1 *d*, *h*, *k*, and fig. 2 *d*), or the margins meet at an acute angle (see fig. 1 *n*, *q*, and fig. 2 *h*, *k*). Other characteristics follow these types. In the first case, the leaf-margin is always perfectly smooth, more or less cartilaginous, and the flowers are always solitary. In the second, the leaf-margin is denticulate-ciliate in the lower half, while the flowers are solitary or up to 3 together and then stalked ; the leaves are also (*S. quadrifaria* excepted) less thickened.

To the first of these types belong all tetramerous and two of the pentamerous species (*S. georgei* and *S. alpigena*), constituting a homogeneous, sharply delimited group, which could well merit sectional rank.

To the second type belong four species, three described below (*S. roylei*, *S. vacillans*, *S. subternata*) and also *S. quadrifaria*. Of the last-mentioned species I have not seen the type, and I am not sure if I have interpreted it correctly in using the specimen *Younghusband T. 62* as a substitute (see fig. 1 *l–n*). This species and *S. roylei* behave as normal saxifrages should do. Not so the other two. The arrangement of the leaves is in both species unstable and changing. In *S. vacillans* they are essentially decussate, but alternate in vigorous or prolonged parts of the caudicles (see fig. 2 *k*, *l*). This variation may be due to hybridization between a decussate-leaved species, for instance *S. georgei*, and some Kabschia with alternate leaves. The plant looks like a somewhat enlarged *S. georgei* with 1–2 flowers on a slender stalk up to 2 cm. long. However, no species with alternate leaves is known which could possibly have given that appearance to a hybrid with *S. georgei*. Furthermore, nothing in pollen or seed formation indicates a primary hybridization.

As puzzling is *S. subternata*, which is unique among saxifrages in having its leaves in whorls, at least partly. Yet the arrangement is not perfect. The majority of the leaves are opposite, but, especially in crowded parts of the caudicles, they are ternate or, rather, subternate. The leaves of the whorls are not completely connate at the base (see fig. 2 *g*). Of the three basal angles in a whorl, the leaf-bases are joined and amplexicaul in two only. In the third they are free. It may also happen that one leaf remains quite free from the other two, in which case they are connate in only one of the angles. This arrangement is peculiar and hard to explain. Some disturbance must have happened to the organization of the plant. Again one might guess that some remote hybridization was the original cause of the instability.

This second group of decussate-leaved Kabschias is confusing. The species are presumably of different genetic origin from the first group of true decussates, and are less advanced along the decussate design.

In all, 54 species of sect. *Kabschia* are now recognized from the Sino-Himalayan mountain-ranges. The patterns of their distribution show some unusual features bearing on the history of these charming cliff-face and fresh-earth dwellers. These plants are highly specialized and are able to live under most adverse conditions on naked rocks and on badly exposed mineral soils ; but they seem to be defenceless against competition from other plants.

In their distribution they are singularly scattered. Of the 54 species no less than 24 have been collected only once. Among these are found several conspicuous and beautiful species, such as *S. decora*, *S. doyalana*, *S. lowndesii*, *S. ludlowii*, *S. mira*, *S. monantha*, *S. mundula* and *S. sherriffii*. They are too conspicuous to have been overlooked by keen-eyed plant-hunters, who, for instance, in recent years have collected the insignificant-looking *S. andersonii* and *S. georgei* 27 and 13 times respectively in the Himalaya. Further, though recent expeditions have so thoroughly combed old collecting-grounds in the Himalaya, they have failed to find 6 of the 11 species previously known. It is apparent that these are all extremely local, existing perhaps only in single localities. Within very restricted areas (as for instance part of Nepal, and the Lhasa region) 13 species have been found on two or more occasions.

Of the rare species, and those of restricted distribution, 11 are found in Nepal, 15 in S.E. Tibet, 6 in Bhutan, 4 in Yunnan, and 1 in Kashmir.

Fairly large areas are inhabited by 9 species, such as *S. pulvinaria* (Kashmir to Kumaun, Nepal and Sikkim), *S. andersonii* (Nepal, Sikkim, Bhutan), *S. afghanica* (Kashmir, Nepal, S.E. Tibet). Only one species, *S. georgei*, extends throughout the greater part of the Himalayan range, from Nepal to north-western Yunnan.

The mode of scattered occurrence is still more accentuated within groups of related species. The most striking example is disclosed by the group characterized by solitary white (rarely pale lilac) stalked flowers. It consists of 8 species: *S. calcicola, S. doyalana, S. lilacina, S. mundula, S. saxatilis, S. saxicola, S. staintonii* and *S. unguipetala.* They are all of a fairly uniform type, supposedly of rather close affinity, and without obvious connexions with other species. It is not perhaps unduly bold to assume that they are all derived from a common stock. These 8 species have been collected only 12 times, in isolated localities from Kansu to Yunnan and westwards to Nepal. Perhaps their hypothetical ancestor was at one time distributed along the whole of this area. This would account for their otherwise inexplicable distribution.

As said before, the Kabschias are confined to exposed rocky habitats, because they are unable to compete with other plants under more fertile conditions. During the upheaval of the Himalaya a good deal of new ground must have become available to the Kabschias and in all probability they flourished exceedingly. But when the upheaval subsided competition from other plants must have increased, driving the Kabschias from their strongholds.

What now remain are probably only the scattered survivors of their Golden Age.

KEY TO THE SINO-HIMALAYAN SPECIES OF *SAXIFRAGA* SECT. *KABSCHIA*

(The unnumbered species, of which the authors are given, are not included in the ensuing enumeration.)

Leaves of caudicles opposite, amplexicaul; flowers white, solitary (exceptions: *S. roylei* and *S. vacillans*, 1–3-flowered; the latter can also have alternate leaves in vigorous shoots):

- Flowers tetramerous:
  - Flowering stalk 1–2 cm. long with 2 pairs of opposite leaves; rosette-leaves with 3–7 calcium-secreting pores; fig. 2 *a–d* . . . . 1. *monantha*
  - Flowering stalk (when flower not sessile) with alternate leaves; rosette-leaves with 1–3 calcium-secreting pores:

Petals 2–3 times longer than sepals ; leaves with 1–3 pores ; fig. 1 *a–d* *decussata* Anthony

Petals (if present) hardly longer than sepals ; leaves with only 1 pore :

Flowers strictly sessile ; leaves rotundate-oblong, 3 mm. long *octandra* H. Sm.

Flowers shortly stalked ; leaves oblong, 5–6 mm. long *nana* Engler

Flowers pentamerous :

Leaves of caudicles with only 1 calcium-secreting pore :

Bases of opposite pair of leaves joining at an acute angle (fig. 1 *n*, *q*), their margins denticulate-ciliate :

Flowers solitary, the stalk 5–6 mm. long ; caudicles columnar, forming pulvinate cushions ; leaves densely imbricate, obtuse, 2–2·5 mm. long ; fig. 1 *l–n* . . . . . *quadrifaria* Engler & Irmscher

Flowers 1–3, the stalk 10–15 mm. long ; caudicles not columnar, forming rather loose tufts ; leaves hardly imbricate, submucronulate, 3–3·5 mm. long ; fig. 1 *o–q* . . . . 2. *roylei*

Bases of opposite pair of leaves joining in an unbroken line (fig. 1 *d*, *h*, *k*), their margins glabrous :

Flowers sessile or subsessile ; caudicles forming large usually loose mat-like tufts ; leaves 3–3·5 mm. long, hardly imbricate or imbricate only at top of caudicles ; fig. 1 *e–h* . . . . 3. *georgei*

Flowers with a stalk 5–7 mm. long ; caudicles columnar, forming small sparse tufts ; leaves densely imbricate, 2–2·5 mm. long ; fig. 1 *i–k* 4. *alpigena*

Leaves of caudicles with 3–7 calcium-secreting pores :

Flowers subsessile ; leaves partly ternate, their margin obscurely denticulate in the lower half ; fig. 2 *e–h* . . . . . 5. *subternata*

Flower-stalk up to 2 cm. long, very slender, with 1–2 flowers ; leaves of vigorous parts of shoots partly alternate, their margin denticulate-ciliate in the lower half ; fig. 2 *i–m* . . . . . . 6. *vacillans*

Leaves of caudicles always alternate ; flowers 1–several :

Leaves without calcium-secreting pores, herbaceous, the margin aristulate-ciliate, cilia longest at the apex ; flowers solitary, white, conspicuous :

Leaves strongly concave in the upper part when full-grown ; fig. 3 *i–l* 7. *williamsii*

Leaves flat :

Flowers sessile or subsessile ; sepals glandular ; limb of petals rotundate-oval, often minutely emarginate ; fig. 3 *a–d* . . 8. *sessiliflora*

Flowers with a stalk 0·5–1 cm. long ; sepals glabrous or nearly so on the back, aristulate-ciliate on the margin ; limb of petals rhomboid ; fig. 3 *e–h* 9. *brevicaulis*

Leaves with 1–many calcium-secreting pores, usually very coriaceous, the margin glabrous at the apex (*S. hypostoma* excepted), denticulate-ciliate or glandular in the lower part :

Petals small, hardly longer than sepals, ciliate on the margin in the lower part; styles less than 0·5 mm. long:

Flowers solitary on a stalk not exceeding 8 mm. in length *rupicola* Franch.

Flowers 2–5 on a stalk 10–50 mm. long:

Leaves obovate, the margin subglabrous; flower-stalk 1–3 cm. long, like the calyx moderately glandular-hairy . . *chionophila* Franch.

Leaves linear-obovate, acute or subacute, the margin with robust denticulation at the base; flower-stalk up to 5 cm. long, like the calyx densely villous with brownish glandular hairs . . . 10. *schneideri*

Petals usually much longer than sepals, never ciliate; styles 1–7 mm. long:

Flowers solitary:

Leaves with only 1 pore (in *S. subsessiliflora* sometimes obscure):

Plant with columnar caudicles forming compact pulvinate cushions; leaves densely imbricate; flowers sessile or subsessile:

Margin of apical part of leaves membranous-ciliate, the apical pore placed beneath the margin; fig. 4 *d–f* . . 11. *hypostoma*

Margin of leaves glabrous at the apex or nearly so, the lower part denticulate-ciliate or glandular, the apical pore placed above the margin:

Leaf-margin with a few glandular hairs in the lower part, elsewhere glabrous; sepals much overlapping, with 1 calcium-secreting pore; flower-stalk short, glandular-hairy; fig. 4 *a–c* 12. *saxorum*

Leaf-margin eglandular, denticulate-ciliate in the lower part; flower-stalk short, glabrous:

Pore very small, placed near the apex of the subacute only slightly coriaceous leaf; petals less than 2 mm. broad; fig. 4 *p* [1] *subsessiliflora* Engler & Irmscher

Pore conspicuous, strictly apical on the truncate subtriquetrous apex of the leaf; petals 2–4·5 mm. broad:

Sepals distinctly broader than long, the margin with 5–10 robust short-stipitate glands; petals rotundate, abruptly contracted into a short claw; fig. 4 *g–i* . 13. *lolaensis*

Sepals as long as broad, or longer; petals gradually narrowed to a more or less indistinct claw:

Sepals with a calcium-secreting pore, slightly recurving; petals rotundate-obtriangular, 3·5–4·5 mm. broad; fig. 4 *j–l* . . . . . 14. *matta-florida*

Sepals without a calcium-secreting pore (or sometimes with a half-developed one), erect, with convex back; petals obovate-oblanceolate, 2–3 mm. broad; fig. 4 *m–o* 15. *pulvinaria*

---

[1] In Engler and Irmscher's original description (Engler, Pflanzenr. IV. 117 : 573 (1919)) the leaves of the caudicles are erroneously said to be " margine apice excepto irregulariter brevissime glanduloso-pilosa ". This is not the case. The leaves of the caudicles are eglandular, their margin, except the glabrous apex, minutely denticulate-ciliate. The mistake is certainly due to Engler and Irmscher's having examined involucral leaves, which are glandular.

Loosely tufted cushion-plant; leaves, even if sometimes aggregated, hardly imbricate; flowers sessile or shortly stalked:

Sepals with a calcium-secreting pore, their margin glandular-hairy; flowers white, shortly stalked; petals obovate, 4–5 mm. long, gradually narrowed into an indistinct claw; leaves minutely apiculate, slightly dilated and glandular at the base; fig. 5 *a–c* 16. *kumaunensis*

Sepals without a calcium-secreting pore:

Sepals broad-ovate with big subsessile glands on the margin; flowers sessile; petals rose-lilac, rotundate-obtriangular, 7·5 mm. long; fig. 5 *d–g* . . . . 17. *lowndesii*

Sepals with short-stipitate glands on the margin and back; flowers shortly stalked; petals yellow, rotundate, abruptly contracted into a short claw, 4 mm. long, 3·8 mm. broad; fig. 5 *h–j* 18. *flavida*

Leaves with several pores (*S. mundula* excepted):

Flowers sessile, inconspicuous, embedded in the rosette-leaves; petals white, obovate, 3–3·5 mm. long . . . *likiangensis* Franch.

Flowers distinctly stalked, conspicuous:

Flowers yellow:

Flower-stalk scarcely 1 cm. long; leaves only slightly thickened in the upper part:

Petals about as long as stamens; basal ⅔ of leaf-margin grossly denticulate-ciliate; fig. 6 *a–c* . . . 19. *nambulana*

Petals much longer than stamens; basal ⅓ of leaf-margin minutely denticulate-ciliate; fig. 6 *h–j* . . . 20. *elliotii*

Flower-stalk 2–6 cm. long; leaves distinctly thickened in the upper part:

Sepals with a calcium-secreting pore; styles 3·5–4 mm. long, at maturity horizontally spreading; fig. 6 *d–g* 21. *buceras*

Sepals without a calcium-secreting pore; styles 1·5–3 mm. long:

Pores 3–4 in upper ¼ of leaf; petals obovate, gradually narrowed into a short indistinct claw; cushions densely pulvinate, the caudicles usually short with imbricate leaves; fig. 7 *e–k* 22. *thiantha*

Pores about 9 in upper ½ of leaf; petals abruptly narrowed into a claw 2 mm. long; cushions rather loose, the caudicles up to 7 cm. long with imbricate leaves only at the top; fig. 7 *a–d* . . . . 23. *kongboensis*

Flowers white to red:

Flowers large, shortly stalked; petals up to 14 mm. long and 7·5 mm. broad, pink, rhomboid-obtriangular, gradually narrowed to the base; leaves linear-obovate, up to 9 mm. long, straight, fairly thin, the margin at the apex slightly denticulate-ciliate, downwards grossly so; fig. 8 *a–c* . . . 24. *ludlowii*

Flowers smaller; petals 5–10 mm. long; leaves much thickened, glabrous at the top:

- Plant copiously branching, forming big cushions; caudicles up to 10 cm. long or longer:
  - Plant rigid, with a ligneous decumbent stem, copiously branching, forming a stiff robust cushion; leaves all densely imbricate, patent; flowers white or pink, the slender delicate stalk less than 1 cm. long; fig. 8 *d–g* . . 25. *mira*
  - Plant not rigid, forming big rather loose cushions; leaves imbricate only at the tops of the caudicles; flowers white, the stalk about 1·5 cm. long; fig. 8 *h–k* 26. *poluniniana*
- Plant short-branching, pulvinate; caudicles only a few cm. in length:
  - Sepals with a calcium-secreting pore; leaves mostly with only 1 pore, linear, nearly straight, moderately coriaceous, denticulate-ciliate only at the very base; flowers white; fig. 9 *g–j* . . . . 27. *mundula*
  - Sepals without a calcium-secreting pore; leaves with 5–9 pores:
    - Flower-stalk and calyx long-ciliate but eglandular; sepals subrectangular, broadly truncate; flowers white; fig. 10 *a–d* . . . . *saxicola* H. Sm.
    - Flower-stalk and calyx glandular-hairy; sepals, even if obtuse, not truncate:
      - Leaf-margin with 1–3 short-stipitate glands towards the base, elsewhere glabrous; leaves 4–5 mm. long; flowers white; fig. 9 *d–f* . . . . . 28. *calcicola*
      - Leaf-margin denticulate-ciliate in the lower part, never glandular:
        - Pores small, 5–7, situated in the much-thickened apical $\frac{1}{4}$ of the nearly straight leaves; lower $\frac{1}{2}$ of leaf-margin finely and densely serrate-ciliate, the ciliation bent strictly upwards; flowers white; fig. 9 *k–m* 29. *doyalana*
        - Pores 7–9, evenly disposed in the upper $\frac{1}{2}$ of the strongly recurving leaves; dentation of leaf-margin not bent upwards:
          - Styles barely 1 mm. long; petals up to 5 mm. long; leaves 4–5 mm. long, obovate-linear, obtuse or subobtuse; fig. 10 *e–g* . . *saxatilis* H. Sm.
          - Styles more than 1·5 mm. long; petals 8–10 mm. long; leaves linear, acute:
            - Leaves 4 mm. long; sepals covered with very short

(0·1–0·2 mm.) glandular hairs ; flowers reddish ; fig. 9 *a–c* . . . . *lilacina* Duthie

Leaves 6–8 mm. long ; glandular hairs of sepals 0·4 mm. long or longer ; flowers white :

Petals rotundate, distinctly clawed ; flower-stalk about 4 cm. long ; fig. 10 *h–j* *unguipetala* Engler & Irmscher

Petals narrow-obovate, gradually tapering to the base ; flower-stalk 5–6 cm. long ; fig. 13 *j–l* 30. *staintonii*

Flowers 2–several (solitary only in dwarfed specimens) :

Flowers yellow :

Petals shorter than stamens, about 4 mm. long and 1·5 mm. broad, gradually narrowed to the base . *meeboldii* Engler & Irmscher

Petals much longer than stamens, about 7 mm. long and 5 mm. broad, rotundate, distinctly clawed ; fig. 11 *g–k* . . . 31. *sherriffii*

Flowers white to red :

Stalk at flowering not raised above the rosette-leaves, at maturity up to 1 cm. long ; flowers 2–3 together :

Leaves ovate-linear, the apex acute and recurving, the margin in the basal part denticulate-ciliate ; fig. 11 *d–f* . 32. *lamarum*

Leaves linear, the apex truncate and not recurving, the margin in the basal part with 4–7 robust short-stipitate glands ; fig. 11 *a–c* 33. *clivorum*

Stalk well raised above the rosette-leaves, 1·5–7 cm. long ; flowers 2–6 :

Leaves oval, 2–3 mm. long ; sepals covered with long (0·4–0·8 mm.) glandular hairs ; flowers 2, magenta ; fig. 12 *a–d* . 34. *decora*

Leaves linear, 4–12 mm. long :

Styles 4–7 mm. long ; sepals glabrous or nearly so ; flowers red *pulchra* Engler & Irmscher

Styles at most 3 mm. long :

Sepals with 1–3 calcium-secreting pores :

Petals deep-rose, about 6·5 mm. long ; leaves acute ; fig. 12 *e–h* . . . . 35. *rhodopetala*

Petals white (rarely light-pink), 3–5 mm. long ; leaves obovate-linear to broadly obcuneate, obtuse to subacute ; fig. 14 *a–g* 36. *andersonii*

Sepals without calcium-secreting pores :

Leaves acute or subacuminate ; flowers white :

Plant densely pulvinate ; leaves imbricate, 7–8 mm. long, silvery, with about 7 pores ; flowers 3–4 on a stalk about 3 cm. long ; fig. 12 *i–k* . . . . 37. *micans*

Plant loosely pulvinate, the caudicles intermittently prolonged and then only sparsely leaved ; leaves imbricate only at the tops of the shoots, 9–12 mm. long, greyish, with 9–17 pores ; flowers 3–6 on a stalk about 7 cm. long ; fig. 14 *h–j* . . . . . 38. *cinerea*

Leaves obtuse or subobtuse ; flowers white or reddish :

Plant densely pulvinate, the caudicles short ; leaves imbricate, 5–6 mm. long, the apical ¼ much thickened and recurving ; flowers 2–4, reddish ; fig. 11 *l–n* 39. *afghanica*

Plant loosely cushioned, the caudicles long ; leaves moderately imbricate, 7–9 mm. long and 2–2·7 mm. broad, fairly thin and usually much recurving ; flowers 3–5, white or pink ; fig. 13 *a–i* . . . 40. *stolitzkae*

The following are omitted :

Saxifraga duthiei Gandog. in Bull. Soc. Bot. France xlvi : 419 (1899). Not seen by me nor by Engler and Irmscher, who (Engler, Pflanzenr. IV. 117 : 575 (1919)) supposed it to be closely related to *S. quadrifaria* Engler & Irmscher. It was referred by Duthie, the collector, to *S. oppositifolia* L.

Saxifraga kansuensis Mattf. apud Diels in Notizbl. Bot. Gart. & Mus. Berl.-Dahl. x : 887 (1930). I have seen only one specimen (*Rock 12525* in Herb. Kew). This is a mixture of possibly poorly developed *S. unguipetala* Engler & Irmscher and of *S. chionophila* Franch.

Saxifraga ramulosa Wall. [Numer. List : 14, n. 446 (1829), *nom. nud.*] ex Ser. in DC., Prodr. iv : 21 (1830). This remains obscure. The meagre material examined does not give any clear idea about it. It somewhat resembles *S. kumaunensis* Engler, but the stalks are two-flowered and the fairly long leaves are pointed. It is not matched in the recent collections.

1. **Saxifraga monantha** H. Sm., sp. nov. (Fig. 2 *a–d*.)

S. decussatae Anthony affinis, sed omnibus partibus major, caule florifero ad 1·5 cm. longo, foliis caulinis in paribus duobus oppositis.

Laxe caespitosa, caudiculis numerosis, ramosis, 2–7 cm. longis et 6–10 mm. diam., superne imbricatim foliatis, partibus vetustis efoliatis ; folia caudiculorum opposita, basi connato-amplexicaulia, ad 5 mm. longa et 2·5–3·7 mm. lata, obovato-ovalia, apice subacuta vel subobtusa, 3–7-foveolata, omnino glabra. *Caulis florifer* tenuis, glanduloso-pilosus, foliis caulinis oppositis basi non connatis, linearibus, apice obtusis, 3–2·2 mm. longis, margine dorsoque basin versus glanduloso-pilosis, unifoveolatis ; flores albi, tetrameri. *Hypanthium* breviter glanduloso-pilosum. *Sepala* obscure tincta, ovata, obtusa, 2 mm. longa et 2–2·2 mm. lata, apice glabra, margine glandulis paucis (3–4) robustis brevissime stipitatis ornata, dorso sparsim glanduloso-pilosa, nervis 3 liberis vel in verruculam confluentibus. *Petala* irregulariter obovata, 6·5 mm. longa et 4–4·5 mm. lata, limbo in unguem indistinctum sensim angustato, nervis 5 ramosis. *Gynoecium* semi-superum, alte fissum, carpellis in stylos sensim angustatis, partibus liberis c. 3 mm. longis.

S.E. Tibet : Cha La, north of Sanga Chöling, 3,900 m. ; on damp rock face ; corolla white ; anthers bright brown ; 14 May 1936, *Ludlow & Sherriff 1584* (holotype in Herb. Brit. Mus.).

2. **Saxifraga roylei** H. Sm., sp. nov. (Fig. 1 *o–q*.)

? *Saxifraga ramulosa* sensu Royle, Ill. Bot. Himal. Mount. : 226, t. 49 fig. 3 (1835).

Caespites humiles subdensos formans, caudiculis numerosis, ramosis, ad 5 cm. longis et c. 7 mm. diam., laxiuscule vel superne subimbricatim foliatis, foliis oppositis non vel minime recurvantibus ; caulis florifer ad 1·5 cm. longus, 1–3-florus, flore albo c. 6 mm. longo. Habitu *S. georgei* Anthony subsimilis, a qua longe distat foliis oppositis angulo peracuto connatis (ut in fig. 1 *q*, nec *h*) et marginibus deorsum denticulato-ciliatis ; verisimiliter ex affinitate *S. quadrifariae* Engler & Irmscher, sed distat caule 1–3-floro, foliis submucronulatis (nec obtusissimis), planta laxiuscule caespitosa et foliosa (nec pulvinata et imbricatim foliosa).

Folia caudiculorum apice subacuta, vulgo minutissime mucronulata, ovato- vel obovato-linearia, ad 3·5 mm. longa, margine inferiore tertia parte denticulato-ciliata, poro singulo subapicali instructa. *Caulis florifer* laxe 3–4-foliatus, pilis glanduliferis longis tenuibus obsitus. *Hypanthium* glanduloso-pilosum. *Sepala* ovata, late acute vel subacuta, laxiuscule glanduloso-pilosa, foveola instructa, nervis 3 sub apicem in verruculam confluentibus. *Petala* c. 4·6 mm. longa et 3·2 mm. lata, limbo subrotundato in unguem brevem abrupte angustato. *Stamina* fere 3 mm. longa. *Gynoecium* subinferum, alte fissum, stylis gracilibus staminibus subaequilongis.

NEPAL : South of Gurjakhani, 3,750 m. ; ledges on rock face ; flowers whitish ; stamens and anthers reddish ; 8 June 1954, *Stainton, Sykes & Williams 3072a* (holotype in Herb. Brit. Mus.).

It was only with hesitation that Royle identified the plant of his figure with the imperfectly known *S. ramulosa* Wall. ex Ser. C. B. Clarke states (Hook. f., Fl. Brit. Ind. ii : 395 (1878)) that this picture of *S. ramulosa* is " bad ", and certainly it is very dissimilar to that species. It seems more than probable that Royle's plant was something different. The plant described above as *S. roylei* agrees accurately with the Royle picture. Size and shape of caudicles, leaves and flowers are very much the same. It is true that no mention was made of the leaves' being opposite, but this character is not easily noticed. However, in the picture several leaves are arranged in pairs. It is highly probable that this is the plant Royle had at hand.

3. **Saxifraga georgei** Anthony in Not. R. Bot. Gard. Edin. xviii : 33 (1933). (Fig. 1 *e–h*.)

NEPAL : Dojam Khola, 5,400 m., 5 July 1952, *Polunin, Sykes & Williams 61*. 3 miles north of Rimi, 4,200 m., 25 May 1952, *Polunin, Sykes & Williams 999*. Bhurchula Lekh, near Jumla, 3,900 m. ; growing in earth under shelter of overhanging rocks, forming small cushions never more than 4 cm. across ; leaves pale green with white tips ; petals white or very pale pink ; anthers red ; 12 July 1952, *Polunin, Sykes & Williams 4575* (a typo paullo distat : planta minore, graciliore ; petalis minoribus, albo-roseis). Near Pudamigaon, near Suli Gad, 3,900 m., 17 June 1952, *Polunin, Sykes & Williams 2236*. East of Chalike Paḥar, 4,200 m.,

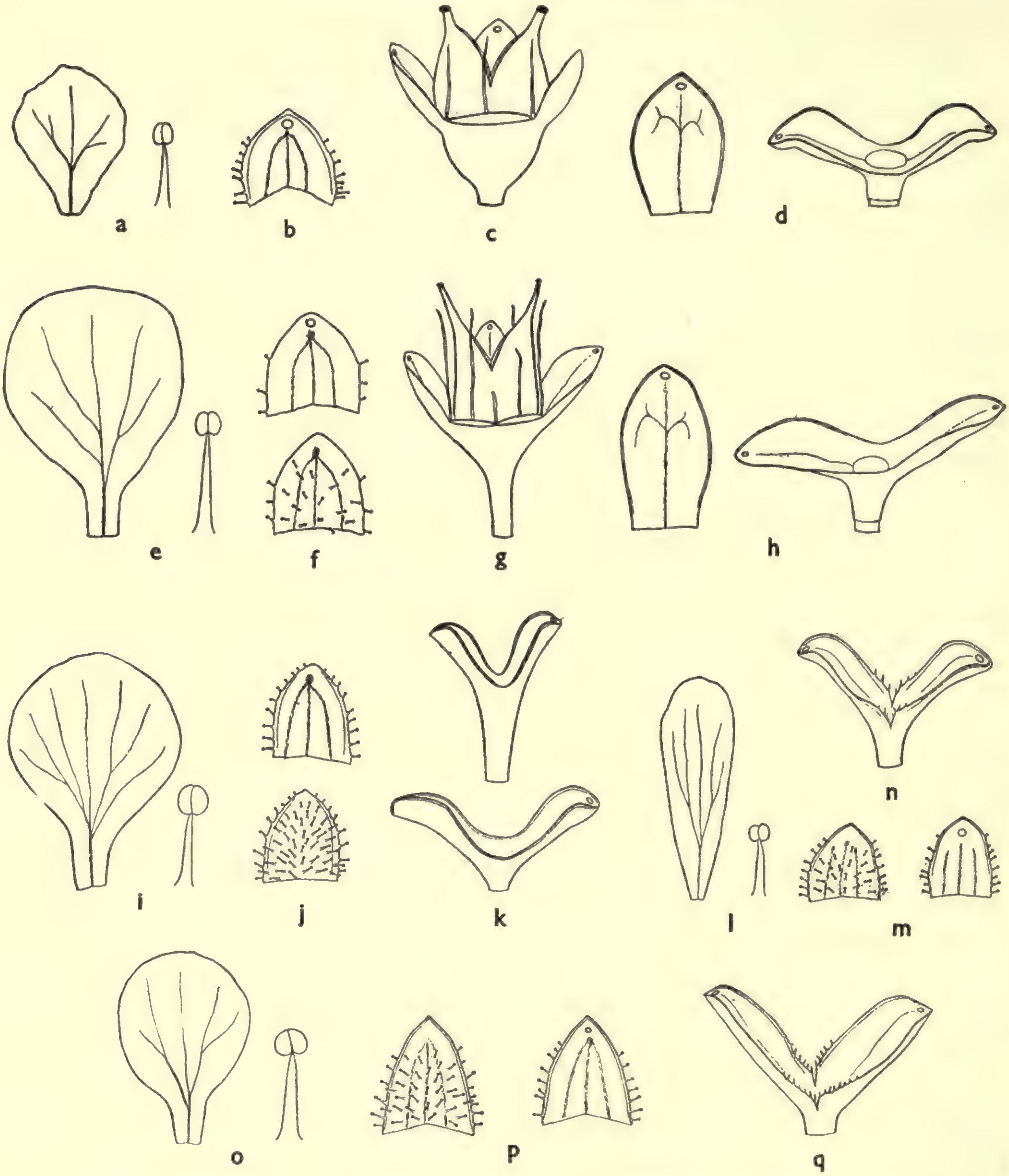


FIG. 1. *Saxifraga decussata* Anthony (type-coll.) : *a*, petal and stamen ; *b*, inside of sepal ; *c*, ripe capsule (hairiness not depicted) ; *d*, leaf and pair of leaves. *S. georgei* Anthony (type-coll.) : *e*, petal and stamen ; *f*, inside and back of sepal ; *g*, ripe capsule (hairiness not depicted) ; *h*, leaf and pair of leaves. *S. alpigena* H. Sm. (holotype) : *i*, petal and stamen ; *j*, inside and back of sepal ; *k*, pairs of leaves from prolonged and from dense part of caudicle. *S. quadrifaria* Engler & Irmscher (*Younghusband T. 62*) : *l*, petal and stamen ; *m*, back and inside of sepal ; *n*, pair of leaves. *S. roylei* H. Sm. (holotype) : *o*, petal and stamen ; *p*, back and inside of sepal ; *q*, pair of leaves. (All × 5.)

23 Sept. 1954, *Stainton, Sykes & Williams 4568.* Above Sauwala Khola, 4,200 m., 5 June 1954, *Stainton, Sykes & Williams 3010.*

BHUTAN : Thangu, Mem La, Paro valley, 3,900 m., 15 May 1949, *Ludlow, Sherriff & Hicks 16255.* Pangte La, Paro Chu, 4,500 m., 17 May 1949, *Ludlow, Sherriff & Hicks 16292a.* Between Barshong and Naha, Thimbu Chu, 3,600 m., 29 May 1949, *Ludlow, Sherriff & Hicks 16400.* Weitang, Bumthang Chu, 4,050 m., 29 May 1949, *Ludlow, Sherriff & Hicks 18999.* Shingbe (Me La), 3,900 m., 2 June 1949, *Ludlow, Sherriff & Hicks 20311.* Lao, Trashi Yangsi Chu, 3,000 m., 14 May 1949, *Ludlow, Sherriff & Hicks 20632.*

S.E. TIBET : Deyang La, 4,050 m., 7 June 1947, *Ludlow, Sherriff & Elliot 15177.*

The species is here recorded for the first time from the Himalaya. It was previously only known from western China. The wide distribution, from China to Nepal, is surprising, and unique in the section. In spite of this wide distribution the variability is moderate and caused by ecological conditions. Deviating most from the type is *Polunin, Sykes & Williams 4575* from Nepal. This plant is somewhat smaller and more slender, with smaller flowers slightly tinged with pink. Coloured flowers are otherwise unknown in *S. georgei.* These distinctions, however, hardly warrant a description.

4. **Saxifraga alpigena** H. Sm., sp. nov. (Fig. 1 *i–k.*)

Caudiculi c. 2 cm. longi et 4 mm. diam., arcte imbricatim foliati, caespites laxos parvos formantes ; folia opposita basi linea non rupta connata (vide fig. 1 *k*) ; caulis uniflorus c. 2-foliatus, 5–7 mm. longus, flore albo. Ex affinitate *S. georgei* Anthony sed caudiculis compactis valde diversa, foliis etiam magis incrassatis et minoribus, sepalis foveola calcium secernenti destitutis distincta ; habitu *S. quadrifariae* Engler & Irmscher subsimilis, quae species pulvinaris foliis oppositis angulo peracuto connatis et in marginis inferiore parte denticulato-ciliatis distat.

Folia caudiculorum ovata ad obovata, apice obtusissima, cartilagineo-marginata, sursum vulgo valde incrassata, foveola apicali instructa, margine glabra, 1·5–2·5 mm. longa et 1–2 mm. lata. *Caulis*, ut *hypanthium*, subdense glanduloso-pilosus. *Sepala* ovata, obtusa vel subobtusa, c. 2 mm. longa et fere aequilata, dorso et margine subdense glanduloso-pilosa, nervis 3 in verruculam confluentibus. *Petala* fere 6 mm. longa et c. 4 mm. lata, limbo rotundato in unguem distinctum angustato. *Stamina* paullo inaequilonga, 1·7–2·7 mm. longa. *Gynoecium* semi-superum, fere ad basin fissum, carpellis in stylos sensim angustatis, partibus liberis c. 2 mm. longis.

NEPAL : Sabze Khola, 4,200 m. ; on moraine ; flowers glistening-white, centre red or green ; 15 June 1950, *Lowndes 1017.* Same locality, 3,900 m. ; among rocks on steep hillside and in river shingles, flowers glistening-white, centre red or green ; 7 June 1950, *Lowndes 959.* Marsiandi, 3,450 m.; deep cushions in moss at streamside ; flowers dead-white ; 5 June 1950, *Lowndes 935* (holotype in Herb. Brit. Mus.).

5. **Saxifraga subternata** H. Sm., sp. nov. (Fig. *2e–h.*)

Caespites magnos densos humiles modo *S. georgei* Anthony formans, caudiculis ad 12 cm. longis, 4–6 mm. diam., imbricatim foliatis, foliis oppositis vel ternatis, fere evaginatis ; caulis uniflorus c. 3 mm. longus, flore albo 7–8 mm. longo.

Folia non vel brevissime vaginata, in caudiculis tenuioribus bina, basi connata et amplexicaulia, in caudiculis robustis ternata, partim basi connata et amplexicaulia, partim libera (vide fig. 2 *g*), 3–4 mm. longa et 1·5–2 mm. lata, ovalia, apice subacuta, parte apicali anguste cartilagineo-marginata, glabra, vulgo modice recurvantia, 3–7-foveolata, margine basin versus obscure denticulato-ciliata. *Caulis*, ut *hypanthium*, glanduloso-pilosus. *Sepala* triangulari-ovata, subobtusa, 2·5 mm. longa et 3 mm. lata, apice glabra subcoriacea foveola calcium secernenti instructa saepe leviter recurvantia, margine et sparsissime etiam in dorso glanduloso-pilosa, nervis 3 sub foveolam confluentibus. *Petala* 6–7 mm. longa et 3 mm. lata, irregulariter obcuneato-obovata, limbo in unguem indistinctum sensim angustato. *Stamina* 4·5 mm. longa, antheris nigris. *Gynoecium* semi-superum, alte fissum, carpellis in stylos c. 2·5 mm. longos attenuatis. *Semina* ovali-ovoidea, subangularia, glabra, 0·7 × 0·35 mm. magna.

S.E. TIBET : Tsangpo valley, above Tse, 29° 23′ N., 94° 22′ E., 3,450 m. ; forming dense cushions on rocks ; leaves encrusted ; sepals green with reddish tip ; petals white ; anthers black ; styles green, red towards apex ; 1 June 1938, *Ludlow, Sherriff & Taylor 4593* (holotype in Herb. Brit. Mus.).

A peculiar plant, unique in the genus in the arrangement of its leaves. In elongate, also in less vigorous, shoots these are opposite, connate at the base and amplexicaul. In more robust parts of the same shoot they are ternate, connate and amplexicaul at two of the joining points and free at the third, or, as sometimes happens, connate only at one joining point, in which case one leaf of the whorl is wholly free from the other two. In all known decussate-leaved species a vagina up to 1 mm. long is developed from the connate leaf-base. Here this vagina is lacking or very much shortened.

One feels tempted to explain the peculiarities of this plant by hybridization between a decussate-leaved species and one with alternate leaves. There is not much in the specific details to indicate possible parents. The size of the petals is suggestive of *S. monantha* (decussate), and their narrowness of *S. pulvinaria* (alternate). But our plant could as well be the result of crossing between other (unknown) parents of corresponding types, and it does not need to have originated in recent times. There are two cases known in the genus when a natural hybrid, by doubling the chromosome number, has arrived at specific behaviour : *S. nathorstii* (Dusén) Hayek from east Greenland, $n = 26$, $=$ *S. aizoides* × *oppositifolia*, both with $n = 13$; and *S. osloensis* Knaben from Scandinavia, $n = 44$, $=$ *S. adscendens* × *tridactylites*, both $n = 22$. Possibly *S. subternata* could have an analogous history. The fertility is in no way reduced. The pollen is good, and the plant seeds freely. The suggested hybrid origin could well be the cause of the instability in the arrangement of the leaves.

6. **Saxifraga vacillans** H. Sm., sp. nov. (Fig. 2 *i–m*.)

Caespites subdensos magnos humiles formans, caudiculis numerosissimis ad 15 cm. longis, 6–8 mm. diam., densiuscule et superne imbricatim foliatis, foliis oppositis vel alternis non vel minime recurvantibus longe persistentibus ; caulis florifer

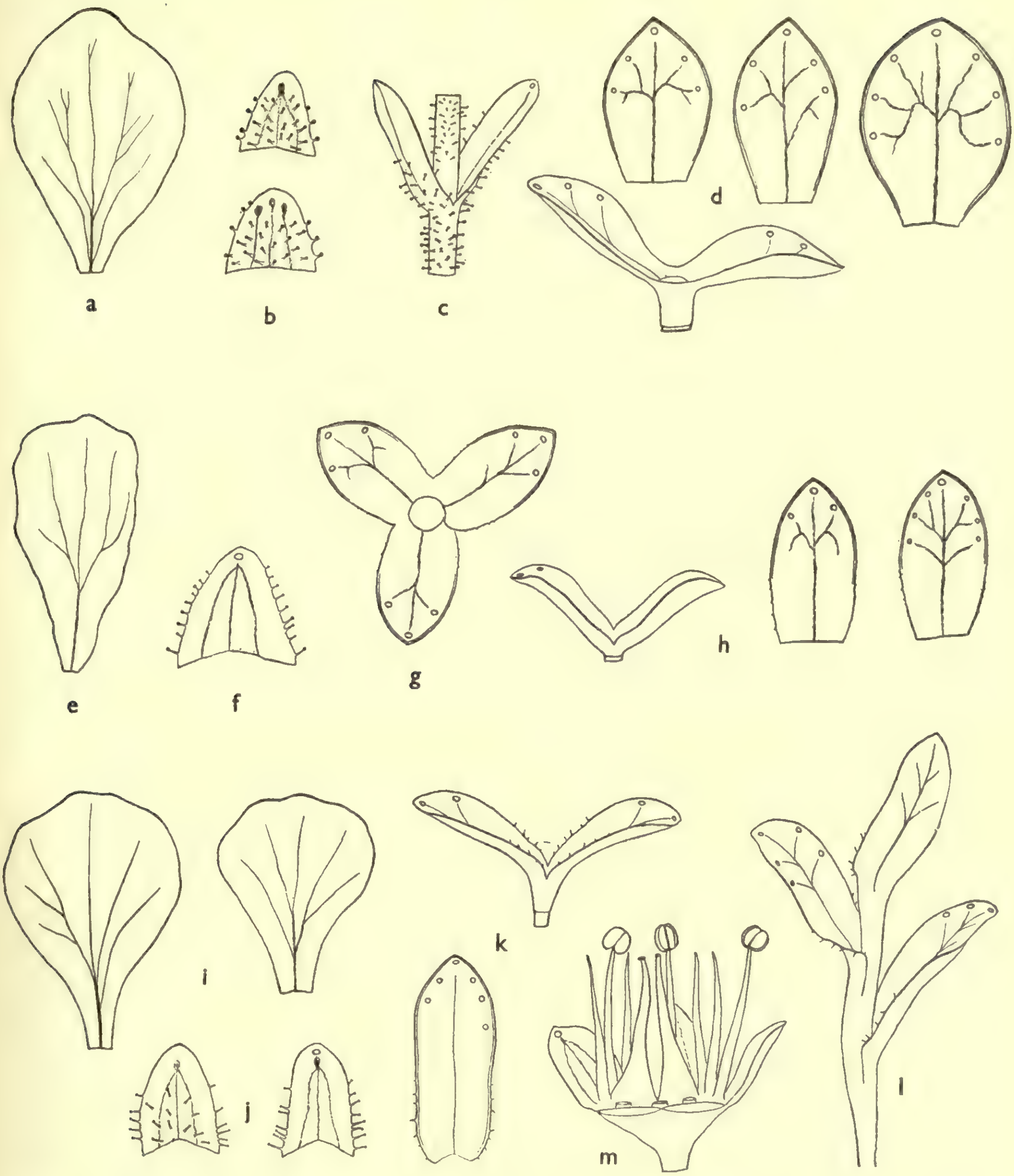


FIG. 2. *Saxifraga monantha* H. Sm. (holotype) : *a*, petal ; *b*, sepals ; *c*, pair of cauline leaves ; *d*, leaves and pair of leaves from caudicle. *S. subternata* H. Sm. (holotype) : *e*, petal ; *f*, inside of sepal ; *g*, subverticillate leaves ; *h*, opposite leaves. *S. vacillans* H. Sm. (holotype) : *i*, petals ; *j*, back and inside of sepal ; *k*, opposite caudicle-leaves ; *l*, alternate caudicle-leaves ; *m*, young fruit (glandular hairiness not depicted). (All × 5.)

tener, 1·5–2 cm. longus, superne saepe nudus, deorsum laxe foliatus, 1–2-florus, flore albo c. 6 mm. longo. Habitu *S. georgei* Anthony subsimilis, a qua distat: foliis basi minus connatis, margine denticulato-ciliatis, foveolis pluribus, caule longiore et non raro 2-floro, gynoecio alte fisso.

Folia caudiculorum opposita, vagina connata, vel in partibus caudiculi vigorosis et prolongatis alterna, semiamplectanter longe decurrentia, 3·5–5 mm. longa, 1·6–2·1 mm. lata, obovato-linearia, apicali dimidia parte glabra, angustissime cartilagineo-marginata, 3–7-foveolata, margine basin versus remotius longe aciculariter denticulato-ciliata. *Caulis* tenuiter glanduloso-pilosus, pilis saepe diametro caulis longioribus; folia caulina eis caudiculorum similia sed angustiora, sursum decrescentia, 3–1-foveolata, glanduloso-pilosa. *Hypanthium* longe glanduloso-pilosum. *Sepala* ovata, subobtusa, c. 2·5 mm. longa et 1·5–2 mm. lata, apice glabra paullo incrassata foveola calcium secernenti instructa, margine et modice etiam in dorso longe glanduloso-pilosa, nervis 3 in verruculam confluentibus. *Petala* 5–6 mm. longa et c. 4 mm. lata, limbo subrotundato in unguem c. 1·5 mm. longum sensim angustato. *Stamina* petalis $\frac{1}{3}$ parte breviora, antheris nigris. *Gynoecium* semisuperum, alte fissum, carpellis in stylos c. 3 mm. longos attenuatis.

BHUTAN: Thimbu Chu, valley above Barshong, 4,050 m., on small, wet cliff face; calyx green; corolla white; filaments pink, anthers black; 25 May 1949, *Ludlow, Sherriff & Hicks 16352* (holotype in Herb. Brit. Mus.).

This curious plant is intermediate between the decussate-leaved and the alternate-leaved groups. In appearance it is—at least in its vegetative parts—somewhat similar to *S. georgei*. There is no likeness to any of the alternate-leaved species (compare discussion under *S. subternata* above).

7. **Saxifraga williamsii** H. Sm., sp. nov. (Fig. 3 *i–l.*)

Caespites subdensos formans, caudiculis 5–7 mm. diam. partim subimbricatim partimque laxiuscule foliatis, foliis adultis apicali tertia parte valde concavis et ibi parum incrassatis, ceterum tenuibus, mortuis longe persistentibus; flores conspicui, albi, solitarii, subsessiles vel breviter pedunculati. Ex affinitate *S. brevicaulis* H. Sm. et *S. sessiliflorae* H. Sm., a quibus distat inter alia planta minore graciliore, foliis apicaliter valde concavis.

Folia caudiculorum 4–5 mm. longa et c. 1·7 mm. lata, linearia vel obovato-linearia, apice obtusa, efoveolata, tota margine longe aristulato-ciliata. *Caulis florifer* ad 3 mm. longus, ut *hypanthium* glaber. *Sepala* rotundata vel ovata vel late ovalia, obtusa vel subacuta, 2·5–4 mm. longa et 2·5–3 mm. lata, margine inaequaliter et irregulariter aristulato-ciliata, ceterum glabra, nervis 3–6, lateralibus liberis, centralibus vulgo sub apicem confluentibus. *Petala* longe persistentia (in capsula annotina saepe adsunt), ad 8·5 mm. longa, 5·6 mm. lata, limbo rotundato in unguem 2 mm. longum abrupte attenuato, nervis c. 5 simplicibus vel ramosis. *Stamina* 3·5–4 mm. longa, antheris brunneis. *Gynoecium* fere superum, dimidia parte fissum, stylis c. 1·7 mm. longis.

NEPAL: Muktinath, 4,050 m.; open grass slopes; calyx green; corolla and filaments white, anthers brown; 28 July 1954, *Stainton, Sykes & Williams 2049*

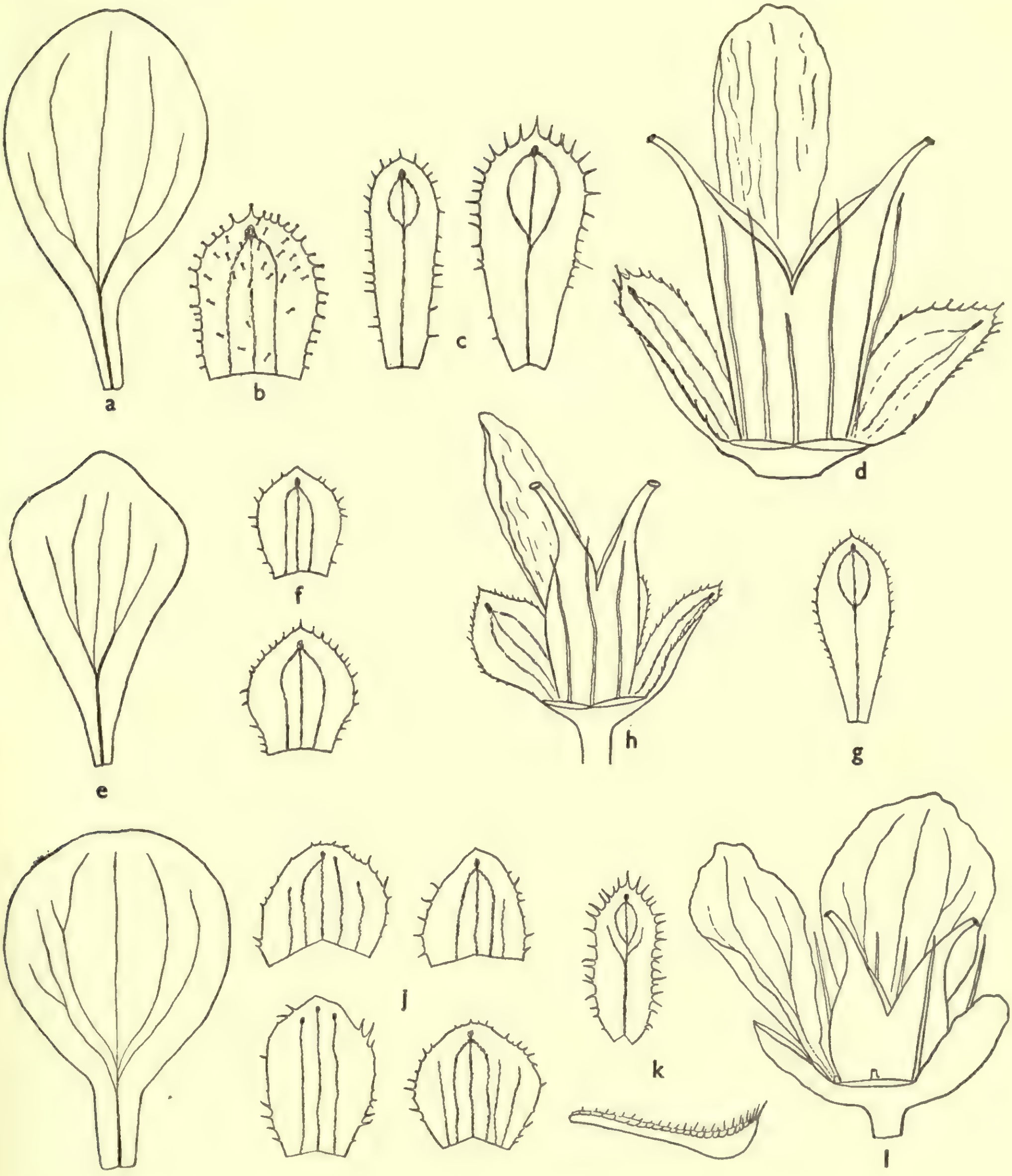


FIG. 3. *Saxifraga sessiliflora* H. Sm. (holotype) : *a*, petal ; *b*, sepal ; *c*, leaves ; *d*, old capsule. *S. brevicaulis* H. Sm. (holotype) : *e*, petal ; *f*, sepals ; *g*, leaf ; *h*, old capsule. *S. williamsii* H. Sm. (holotype) : *i*, petal ; *j*, sepals ; *k*, leaves seen from above and laterally ; *l*, old capsule. (All × 5.)

(holotype in Herb. Brit. Mus.). Samargaon (N. of Tukucha), 4,800 m., 16 Aug. 1954, *Stainton, Sykes & Williams 7250.* Taglung (S. of Tukucha), Kali Gandaki, 4,350 m., 16 July 1954, *Stainton, Sykes & Williams 1818.* Near Chalike Pahar, 4,350 m., 6 Aug. 1954, *Stainton, Sykes & Williams 3772.* Above Dogadi Khola, 4,500 m., 12 Aug. 1954, *Stainton, Sykes & Williams 3836.*

8. **Saxifraga sessiliflora** H. Sm., sp. nov. (Fig. 3 *a–d.*)

S. brevicauli H. Sm. arcte affinis et subsimilis sed distat : planta robustiore, caudiculis c. 8 mm. diam. ; foliis caudiculorum ad 6 mm. longis et 2·5 mm. latis, margine apicem versus arctius aristulatis ; caule florifero vix ad 1 mm. longo sparsius glanduloso ; sepalis late obovatis ad 4 mm. longis et 3 mm. latis, margine densiuscule glanduloso-pilosis, pilis apicalibus robustioribus ad 0·4 mm. longis, dorso et saepe etiam intus modice et tenuiter glanduloso-pilosis ; petalis ad 9 mm. longis et 5 mm. latis, limbo late ovali saepe minutissime emarginato in unguem angustum ad 2·5 mm. longum subabrupte contracto ; capsula annotina sepalis et petalis persistentibus, paullo obconice cylindracea, parte indivisa fere 4 mm. longa, stylis c. 1 mm. longis ; seminibus minute papillosis, 0·9 × 0·4 mm. magnis, paullo curvatim ellipsoideis.

S.E. TIBET : Charme, Chayul, Le La, 4,650 m. ; growing on vertical rock faces in large clumps ; corolla pure white ; 4 July 1936, *Ludlow & Sherriff 2288* (holotype in Herb. Brit. Mus.). Tze Ga, 4,200 m., 9 July 1935, *Kingdon-Ward 11944.*

9. **Saxifraga brevicaulis** H. Sm., sp. nov. (Fig. 3 *e–h.*)

Caespites densos formans, caudiculis 2–4 cm. longis, c. 6 mm. diam., imbricatim foliatis, foliis mortuis longe persistentibus ; flores solitarii, albi, 7–10 mm. longi, caule florifero, deorsum foliato, 0·5–1 cm. longo. Ex affinitate *S. sessiliflorae* H. Sm.

Folia caudiculorum oblanceolata, apice subacuta, efoveolata, margine praecipue apicem versus aristulato-ciliata, ad 4·7 mm. longa et 1·8 mm. lata. *Caulis florifer* tenuiter glanduloso-pilosus, sursum efoliatus. *Hypanthium* brevissimum, tenuiter glanduloso-pilosum. *Sepala* 2·5–3 mm. longa et 2–2·6 mm. lata, ovata, basi modice angustata, late acuta, apice glabra vel aristulata, margine aristulato-ciliata, dorso glabra vel basin versus parcissime glanduloso-pilosa. *Petala* longissime persistentia, staminibus $\frac{1}{3}$ longiora, 7–8 mm. longa et c. 4 mm. lata, rhomboideo-spathulata, limbo sensim in unguem indistinctum angustato. *Gynoecium* superum, modice fissum, stylis subrectis 1 mm. longis. *Capsula* annotina sybcylindracea, parte indivisa 3 mm. longa et 2·2 mm. crassa ; semina (ex n. *9766*) irregulariter ovoidea, 0·8 × 0·4 mm. magna.

S.E. TIBET : Reting, 60 miles north of Lhasa, 4,500 m. ; cushion plant on open hillside ; flowers white ; 30 July 1942, *Ludlow & Sherriff 8959* (holotype in Herb. Brit. Mus.). Same locality, 4,350 m., 18 July 1944, *Ludlow & Sherriff 11018.* Hills north of Lhasa, 4,500 m., 10 July 1942, *Ludlow & Sherriff 8807.* Sha La, south of Lhasa, 4,500 m., 11 July 1943, *Ludlow & Sherriff 9766.*

10. **Saxifraga schneideri** Engler in Notizbl. Bot. Gart. & Mus. Berl.-Dahl. vii: 540 (1921).

S.E. TIBET: Zayul, Sangachu Dzong, 3,600 m.; on limestone cliffs; 10 Sept. 1933, *Kingdon-Ward 10834.*

Previously known only from western Yunnan. The identification, however, is not quite certain. The plant, collected in late fruiting stage, is rather small for the species. It could represent an undescribed form, coming in between *S. schneideri* and *S. chionophila.* Mixed on the same sheet is another, sterile, Kabschia, which does not agree with any known species.

11. **Saxifraga hypostoma** H. Sm., sp. nov. (Fig. 4 *d–f.*)

S. pulvinariae H. Sm. affinis et similis sed distat: margine foliorum basali parte glabro, apicali dimidia parte longe scarioso-laciniato; foveola infra marginem in apice truncato locata; sepalis ovatis, c. 1·5 mm. longis et latis, dorso glabris, margine pilis paucis longis subrobustis glanduliferis ornatis; petalis rotundato-obtriangularibus, 4 mm. longis et fere aequilatis, nervis 3–4 simplicibus.

NEPAL: Jargeng Khola, 4,800 m.; close silvery cushions on bare scree; flowers white with green centre, stemless; 3 July 1950, *Lowndes 1108* (holotype in Herb. Brit. Mus.). Below Padmara Lagna, 5,250 m.; open stony slopes; leaves white; sepals pink; petals white; filaments white, anthers orange; 24 Sept. 1952, *Polunin, Sykes & Williams 3595.* Lamjung, 4,350 m.; on sand and boulders forming pale green cushions; flowers over; 13 July 1954, *Stainton, Sykes & Williams 6309.* Near Chalike Pahar, 4,500 m.; rock ledges and screes; flowers white; anthers dark; 17 June 1954, *Stainton, Sykes & Williams 3172.*

12. **Saxifraga saxorum** H. Sm., sp. nov. (Fig. 4 *a–c.*)

Caespites densos formans, caudiculis columniformibus ad 4 cm. longis et c. 4 mm. diam., foliis erectis arcte imbricatis longe persistentibus; flores solitarii, albi, sessiles. Ex affinitate *S. subsessiliflorae* Engler & Irmscher, a qua inter alia distat foliis caudiculorum margine remote glanduloso-pilosis (nec denticulato-ciliatis), sepalis latioribus quam longis foveola instructis, gynoecio semi-supero (nec alte immerso).

Folia caudiculorum linearia, recta, apice obtusa sed minute apiculata, c. 4 mm. longa et 1·5 mm. lata, sursum modice incrassata, unifoveolata, margine parte dimidia apicali glabra, basin versus brevistipitate glandulosa. *Folia florem involucrantia* ceteris similia sed fere tota longitudine subrobuste glanduloso-pilosa. *Hypanthium* glabrum vel interdum parce glandulosum. *Sepala* late ovata, late subacuta, 1·7 mm. longa et 2·2–2·5 mm. lata, foveola calcium secernenti instructa, apice dorsoque glabra, ceterum margine robuste glanduloso-pilosa, nervis 3 liberis. *Petala* 3·2–4 mm. longa et 2·1–2·8 mm. lata, limbo subovali in unguem indistinctum attenuato, nervis 3 simplicibus vel ramosis. *Stamina* 2·5 mm. longa, stylis sublongiora. *Gynoecium* semi-superum, alte fissum, carpellis in stylos breves sensim angustatis.

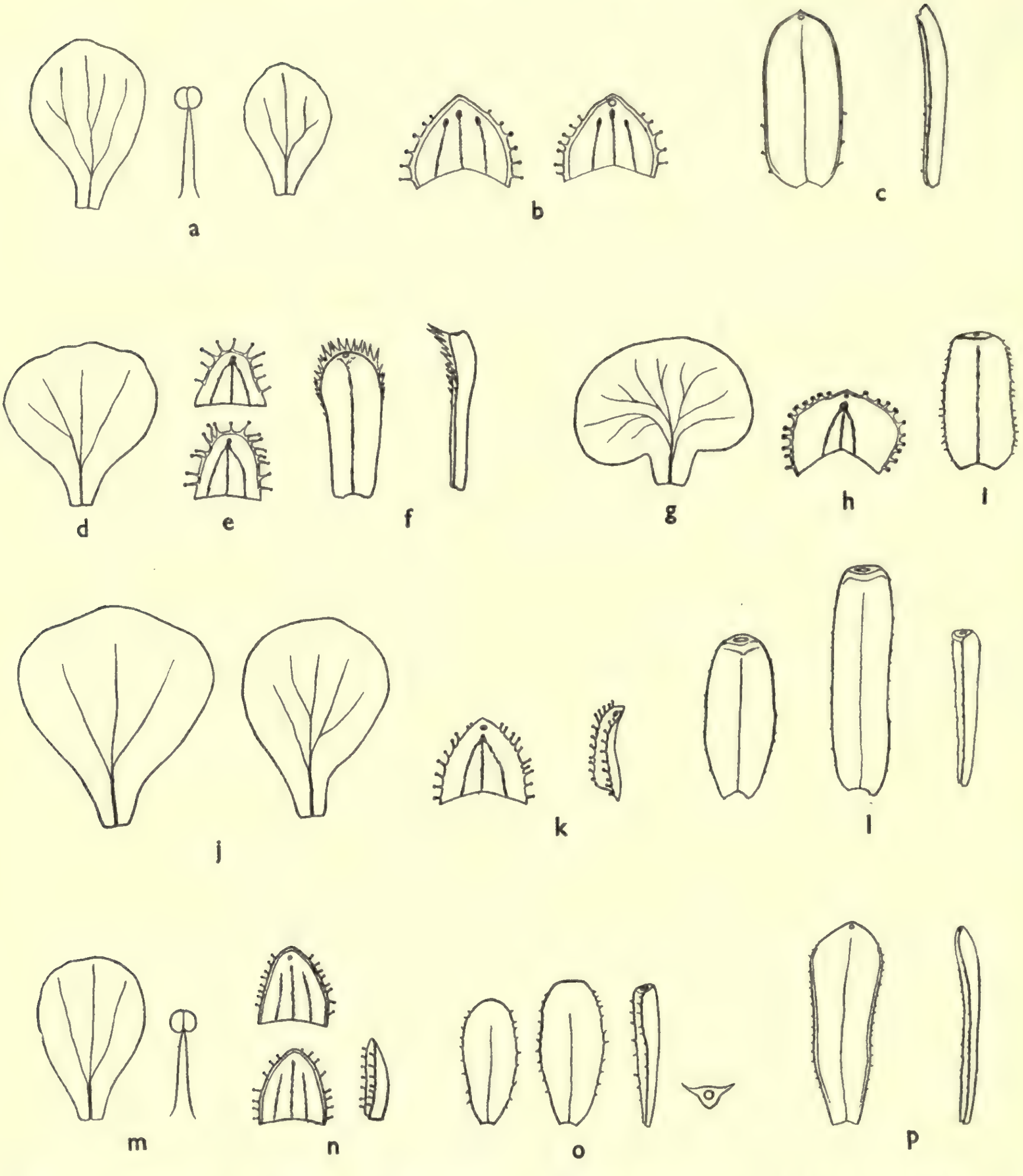


FIG. 4. *Saxifraga saxorum* H. Sm. (holotype) : *a*, petals and stamen ; *b*, back and inside of sepal ; *c*, leaves seen from above and laterally. *S. hypostoma* H. Sm. (holotype) : *d*, petal ; *e*, sepals ; *f*, leaves seen from below and laterally. *S. lolaensis* H. Sm. (holotype) : *g*, petal ; *h*, inside of sepal ; *i*, leaf. *S. matta-florida* H. Sm. (holotype) : *j*, petals ; *k*, sepals, inside and seen laterally ; *l*, leaves seen from above and laterally. *S. pulvinaria* H. Sm. (*Ludlow & Sherriff 8444*) : *m*, petal and stamen ; *n*, sepals, inside, back and seen laterally ; *o*, leaves seen from above, laterally and from apex. *S. subsessiliflora* Engler & Irmscher (type-coll.) : *p*, leaves seen from above and laterally. (All × 5.)

BHUTAN: Dungshinggang (Black Mountain), 3,900–4,200 m.; growing in tufts on open rocks and cliff faces; 16 June 1937, *Ludlow & Sherriff 3259a* (holotype in Herb. Brit. Mus.). Assam-Bhutan frontier, Orka La, 4,200 m.; on cliffs, exposed face; a cushion plant with white flowers; 8 June 1938, *Kingdon-Ward 13723.*

13. **Saxifraga lolaensis** H. Sm., sp. nov. (Fig. 4 *g–i.*)

S. pulvinariae H. Sm. arcte affinis et similis, sepalis latioribus quam longis, margine robuste breviglandulosis, superimpositis, petalis perlatis, inter alia distincta.

Folia caudiculorum recta, linearia, c. 3 mm. longa et 1·5 mm. lata, apice truncato-subtriquetro unifoveolata, margine tota longitudine crebre denticulato-ciliata, ceterum glabra. *Caulis florifer* 1–3 mm. longus, glaber, foliis caulinis florem subinvolucrantibus margine glanduloso-pilosis. *Hypanthium* perbreve, glabrum. *Sepala* 1·5 mm. longa et 2·5 mm. lata, foveola minuta instructa, margine glandulis robuste brevistipitatis ornata, dorso glabra. *Petala* ad 3·5 mm. longa et 4·4 mm. lata, limbo late rotundato in unguem brevem subcordatim abrupte contracto.

S.E. TIBET: Pachakshiri, Lo La, 28° 45′ N., 94° 0′ E., 3,900 m.; growing in large cushion-like clumps on cliff faces, south face, common; flowers creamy-white; 15 May 1938, *Ludlow, Sherriff & Taylor 3775* (holotype in Herb. Brit. Mus.).

14. **Saxifraga matta-florida** H. Sm., sp. nov. (Fig. 4 *j–l.*)

Caespites compactos humiles formans, caudiculis columnaribus densissime confertis, imbricatim foliatis, ad 4 cm. longis, 4–5 mm. diam.; flores conspicui, albi, sessiles, ad 9 mm. diam. *S. pulvinariae* H. Sm. arcte affinis, praecipue distat caule florifero brevissimo glabro, hypanthio glabro, sepalis modice recurvantibus foveola calcium secernenti instructis, petalis majoribus et multo latioribus.

Folia caudiculorum eis *S. pulvinariae* subsimilia, recta, apice incrassata unifoveolata orbiculari-truncata. *Caulis florifer* nullus vel subnullus, glaber, foliis paucis margine glanduloso-pilosis involucratus. *Hypanthium* glabrum. *Sepala* ovata, subobtusa, subrecta, c. 1·8 mm. longa et aequilata, foveola calcium secernenti instructa, margine pilis glanduliferis c. 11 ornata, dorso glabra. *Petala* c. 5 mm. longa et 3·5–4·5 mm. lata, limbo rotundato vel rotundato-obtriangulari in unguem brevem sensim angustato. *Stamina* 1·5 (demum 2·2) mm. longa. *Gynoecium* alte fissum, carpellis in stylos brevissimos sensim attenuatis.

BHUTAN: Trashi Yangsi Chu, Lao, 3,000 m.; growing on dripping cliffs in moss; flowers white; 14 May 1949, *Ludlow, Sherriff & Hicks 20632a* (holotype in Herb. Brit. Mus.).

S.E. TIBET: Drichung La, 4,800 m.; on rocks and cliff ledges; a cushion plant with white flowers; 27 June 1935, *Kingdon-Ward 11818.*

15. **Saxifraga pulvinaria** H. Sm., nom. nov. (Fig. 4 *m–o.*)

Saxifraga imbricata Royle, Ill. Bot. Himal. Mount.: 226, t. 49 fig. 1 (1835); non *S. imbricata* Lam. (1778).

KASHMIR: Mashoo Nullah, 4,500 m.; cushion plant on dry hillslopes; flowers white; 24 June 1941, *Ludlow & Sherriff 8444.* Zoji La, 3,900 m., 26 Aug. 1940,

Ludlow & Sherriff 8022. Hispar Glacier, left bank, ridge west of Makerum, 4,500–4,800 m., 4 Aug. 1939, *Scott-Russell 1482, 1484.* Same locality, 4,500 m., 2 Aug. 1939, *Scott-Russell 1464.* Biafo Glacier, Sokar La, 4,950 m., 18 Aug. 1939, *Scott-Russell 1598.*

SIMLA HILL STATES: Rupin Pass, 4,350 m., 8 July 1939, *Ludlow & Sherriff 7415.*

KUMAUN: Nipchang valley, Darma, 4,200–4,500 m., 31 Aug. 1884, *Duthie 2885* (sub nomine *S. ramulosa*).

NEPAL: 6 miles N.E. of Saipal, 5,700 m., 23 Aug. 1954, *Arnold 170.* Marem Bhanjyang, Chharkabhot, 5,850 m.; growing in rock crevices, north aspect; flowers white; 21 June 1952, *Polunin, Sykes & Williams 1184.* Barbung Khola, Kaya Khola, 4,350 m., 6 June 1952, *Polunin, Sykes & Williams 1092.* Phoksumdo Tal, 3,810 m., 11 June 1952, *Polunin, Sykes & Williams 2203.* Dhudkund, 4,950 m., 5 July 1949, *Polunin 842.* Khola Kharka, 5,100 m., 17 July 1949, *Polunin 1103a.*

The last-mentioned two collections, *Polunin 1103a* and *842* (sterile), are different from typical *S. pulvinaria*: foliorum apex non triquetrus, modice incrassatus, foveola, ut videtur, infra marginem locata. The material is too meagre to judge the taxonomic value of this variant.

The type of Royle's *S. imbricata* was collected in Kunawar, Simla Hill States. As the Royle collections are not available, the type cannot be examined. However, there can be no doubt about the nature of the species. Recent collections from the region where the type was gathered are in perfect agreement with Royle's excellent illustration. This is so exactly matched by *Ludlow & Sherriff 8444* that this specimen could surely serve as a substitute for the type.

The species is also figured in Engler and Irmscher's monograph (Engler, Pflanzenr. IV. 117: 574, fig. 120 (1919)) but their drawings are partly incorrect. The caudicles are depicted with strongly recurving, spreading, acute leaves. In fact, the leaves are closely appressed, and, so far from their being recurved, their back is usually slightly convex with the truncate apex pointing strictly upwards.

16. **Saxifraga kumaunensis** Engler, Pflanzenr. IV. 117: 573, fig. 119 (1919). (Fig. 5 *a–c*.)

NEPAL: Dozam Khola, near Simikot, 3,300–3,600 m.; crevices of wet rock face; sepals pale green; petals white; filaments pale yellow, anthers brown, pollen yellow; ovaries green; 30 May 1952, *Polunin, Sykes & Williams 4219.* 3½ miles east of Saipal, 4,800 m., 31 Aug. 1954, *Arnold 321.*

17. **Saxifraga lowndesii** H. Sm., sp. nov. (Fig. 5 *d–g*.)

Caudiculi ramosi ad 12 cm. longi et 7–9 mm. diam., aetate decumbentes, subdense foliati, caespites laxos formantes; flores solitarii, intense lilacini, in apicibus ramorum sessiles, fere 10 mm. diam. Species insignis ex affinitate obscura, habitu et colore floris *S. oppositifoliam* L. in memoriam revocans.

Folia caudiculorum herbacea, non incrassata, obovato-linearia, apice obtusa, recta vel subrecta, 5–7 mm. longa et 2–2·5 mm. lata, unifoveolata, margine anguste cartilagineo-marginata, basin versus glandulis parvis brevistipitatis 3–5 instructa.

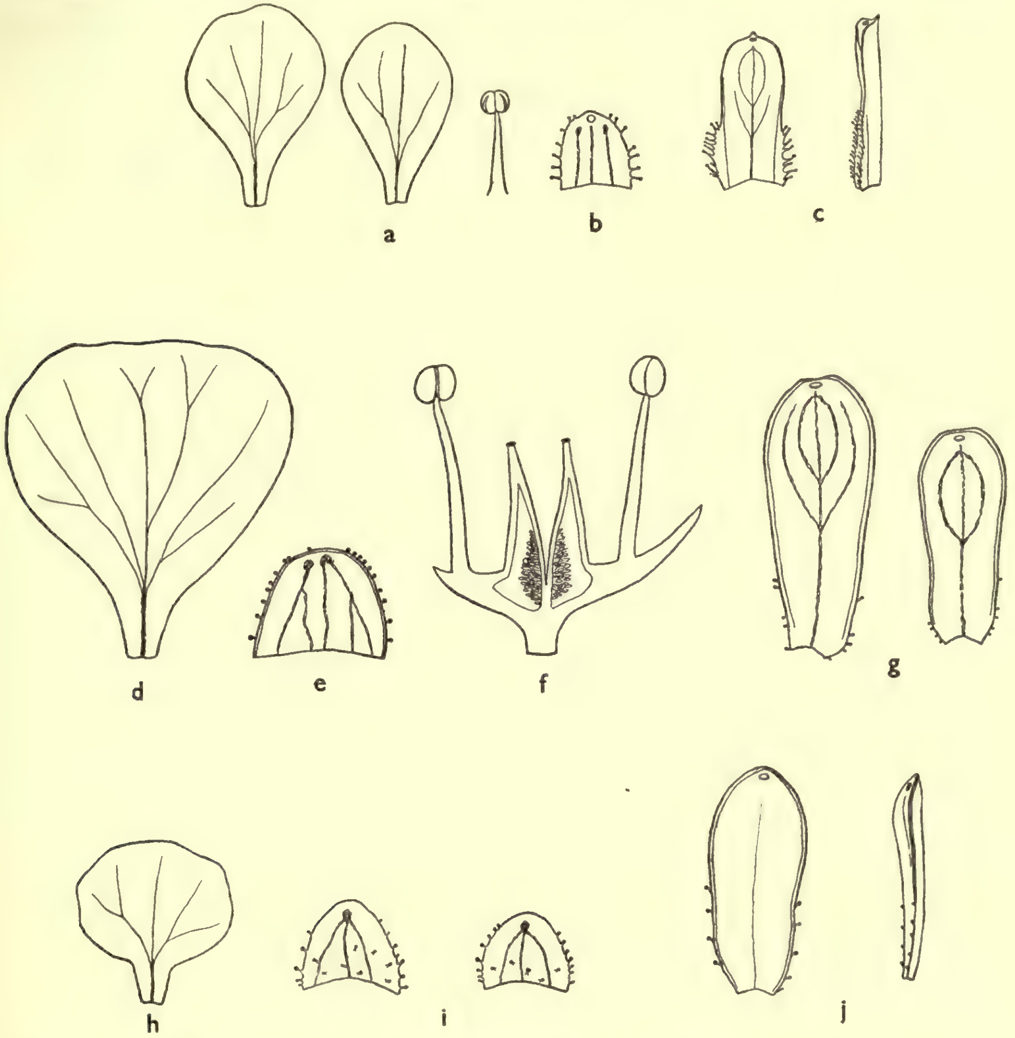


FIG. 5. *Saxifraga kumaunensis* Engler (type-coll.) : *a*, petals and stamen ; *b*, inside of sepal ; *c*, leaves seen from above and laterally. *S. lowndesii* H. Sm. (holotype) : *d*, petal ; *e*, sepal ; *f*, inner part of flower in longitudinal section ; *g*, leaves. *S. flavida* H. Sm. (holotype) : *h*, petal ; *i*, sepals ; *j*, leaves seen from above and laterally. (All × 5.)

Caulis florifer brevissimus vix ad 2 mm. longus, glaber. *Hypanthium* glabrum. *Sepala* late ovato-rotundata, ad 2·5 mm. longa et 3 mm. lata, dorso glabra, margine glandulis luteis brevissime stipitatis ornata, nervis 3–5 in verruculas 1–2 confluentibus. *Petala* 7 mm. longa et fere aequilata, limbo rotundato-obtriangulari in unguem c. 1 mm. longum angustato. *Stamina* 4–4·5 mm. longa. *Gynoecium* fere ad basin fissum, carpellis in stylos crassos indistinctos sensim attenuatis, partibus liberis 3 mm. longis.

NEPAL : Sabze Khola, 4,050 m. ; forming mats among wet rocks on steep hillside ; flowers brilliant rose-lilac ; 7 June 1950, *Lowndes 958* (holotype in Herb. Brit. Mus.).

This pretty plant of the well-watered high alpine zone shows no clear connexion with any other species of the section. The likeness to *S. oppositifolia* is only superficial.

18. **Saxifraga flavida** H. Sm., sp. nov. (Fig. 5 *h–j*.)

Caespites latos humiles subdensos formans, caudiculis numerosissimis, ramosis, ad 7 cm. longis et 7–10 mm. diam. ; caules floriferi uniflori, 0·5–1 cm. longi, vulgo densiuscule foliati ; flores pallide sulphurei, petalis in anthesi patentibus, c. 8 mm. diam., vix 6 mm. longi. Ex affinitate obscura, nisi *S. elliotii* H. Sm. remote affinis.

Folia caudiculorum ad 5 mm. longa et 2·2 mm. lata, subobovato-linearia, apice obtusa, unifoveolata, anguste cartilagineo-marginata, margine basali dimidia parte glandulis paucis (3–5) brevistipitatis instructa, ceterum glabra, apice recto modice incrassato. *Caulis florifer* glanduloso-pilosus, exsertus vel foliis involucratus, foliis caulinis eis caudiculorum similibus sed margine magis glandulosis et sursum decrescentibus. *Hypanthium* glandulis brevistipitatis modice instructum. *Sepala* late ovata, c. 1·7 mm. longa et 2·1–2·4 mm. lata, patentia, apice glabra, basin versus margine dorsoque remote brevistipitato-glandulosa, nervis 3 sub apicem confluentibus. *Petala* 4 mm. longa et 3·8 mm. lata, limbo patenti rotundato in unguem erectum vix 1 mm. longum abrupte contracto, nervis 3, lateralibus ramosis. *Gynoecium* semi-superum, alte fissum, carpellis in stylos vix 1 mm. longos sensim angustatis.

BHUTAN : Ritang, Tang Chu, 4,350 m. ; growing in large clumps on open cliff face ; corolla rather pale sulphur-yellow ; anthers golden-yellow ; 7 June 1937, *Ludlow & Sherriff 3212* (holotype in Herb. Brit. Mus.).

19. **Saxifraga nambulana** H. Sm., sp. nov. (Fig. 6 *a–c*.)

Pulvinatim caespitosa, caudiculis numerosissimis ad 3 cm. longis, imbricatim foliatis, foliis mortuis longe persistentibus ; caulis vix ad 1 cm. longus, laxe 4–6-foliatus, uniflorus, flore luteo. *S. thianthae* H. Sm. arcte affinis, sed distat caule breviore, sepalis rectis efoveolatis, petalis minoribus angustioribus staminibus aequilongis vel subbrevioribus, foliis latioribus in margine robustius denticulato-ciliatis.

Folia caudiculorum ad 5·5 mm. longa et c. 2 mm. lata, obovato-linearia, apice saepe minute apiculata, ⅓ parte apicali coriaceo-incrassata 5-foveolata glabra, ceterum in margine subrobuste denticulato-ciliata, tota longitudine anguste cartilagineo-marginata. *Caulis florifer* longe glanduloso-pilosus ; folia caulina c. 5 mm. longa, apice acuta, apicali parte viridia subcoriacea 1-foveolata, basali longiore parte membranacea rubro-colorata, prope basin margine etiam in dorso glanduloso-pilosa. *Hypanthium* longe et dense glanduloso-pilosum. *Sepala* ovata, subacuta vel acuta, 4 mm. longa et fere 3 mm. lata, margine dorsoque (parte apicali excepta) longe glanduloso-pilosa. *Petala* 7 mm. longa et 3 mm. lata, limbo ovali sensim in unguem c. 1·5 mm. longum attenuata, nervis 3–4 simplicibus. *Stamina* petalis sublongiora vel aequalia. *Gynoecium* alte fissum, stylis erectis c. 2 mm. longis.

S.E. TIBET : Pome, Tongkyuk River, Nambu La, 4,200 m. ; in clumps on rock faces ; corolla yellow ; 5 June 1947, *Ludlow, Sherriff & Elliot 13850* (holotype in Herb. Brit. Mus.).

20. **Saxifraga elliotii** H. Sm., sp. nov. (Fig. 6 *h–j.*)

Caespites laxos formans, caudiculis numerosis, ramosis, brevibus vel ad 6 cm. elongatis, densiuscule foliatis, foliis interdum suboppositis ; flores solitarii, lutei, breviter pedunculati vel in ramis subdense foliatis fere sessiles. Verisimiliter ex affinitate *S. thianthae* H. Sm.

Folia caudiculorum coriacea, modice incrassata, subrecta vel paullo recurvantia, 4–6 mm. longa et 1·5–2 mm. lata, obovato-linearia, apice subobtusa vel subacuta c. 7-foveolata, fere tota longitudine anguste cartilagineo-marginata, dimidia inferiore parte minute denticulato-ciliata. *Caulis florifer* indistinctus, 2–5 mm. longus, glanduloso-pilosus, vulgo foliis paucis eis caudiculorum similibus sed margine et dorso glanduloso-pilosis subinvolucratus ; flores in eodem specimine magnitudine paullo variabiles. *Hypanthium* sparse nigro-glanduloso-pilosum. *Sepala* 2·5–3·5 mm. longa et 2–2·5 mm. lata, ovata, subacuta vel acuta, foveola minuta calcium secernenti instructa, apice glabra, ceterum margine dorsoque modice glanduloso-pilosa. *Petala* 5–7 mm. longa et 3·5–4·5 mm. lata, limbo obovato in unguem brevem sensim angustato, nervis 3–5 iterum ramosis. *Stamina* 3–5 mm. longa. *Gynoecium* fere superum, alte fissum, stylis erectis c. 2 mm. longis.

S.E. TIBET : Pome, Lokmo, 10 miles above Tongkyuk Dzong, 3,000 m. ; cushion plant on boulders on steep hillside ; corolla bright yellow ; calyx pale green ; 26 Mar. 1947, *Ludlow, Sherriff & Elliot 12309* (holotype in Herb. Brit. Mus.). Pome, 15 miles west of Tongkyuk Dzong, 2,850 m ; among stones beside stream ; corolla bright yellow ; 29 Mar. 1947, *Ludlow, Sherriff & Elliot 12318.*

No. *12318* (2 young small specimens only) shows a somewhat larger plant, very loosely tufted, having leaves up to 9 mm. in length with 7–11 pores, and petals up to 9 mm. long. The differences are probably due to the more favourable ecological conditions along a stream at a lower altitude.

21. **Saxifraga buceras** H. Sm., sp. nov. (Fig. 6 *d–g.*)

Caespites subdensos formans, caudiculis numerosissimis, ramosis, subdense vel superne imbricatim foliatis, ad 6 cm. longis et c. 6 mm. diam. ; caulis uniflorus, laxe c. 7-foliatus, ad 3·5 cm. longus, flore magno luteo, stylis longissimis demum horizontaliter patentibus. Affinis *S. kongboensi* H. Sm. a qua inter alia distat foliis duplo minoribus lineari-obovatis, sepalis foveola calcium secernenti destitutis, stylisque longissimis.

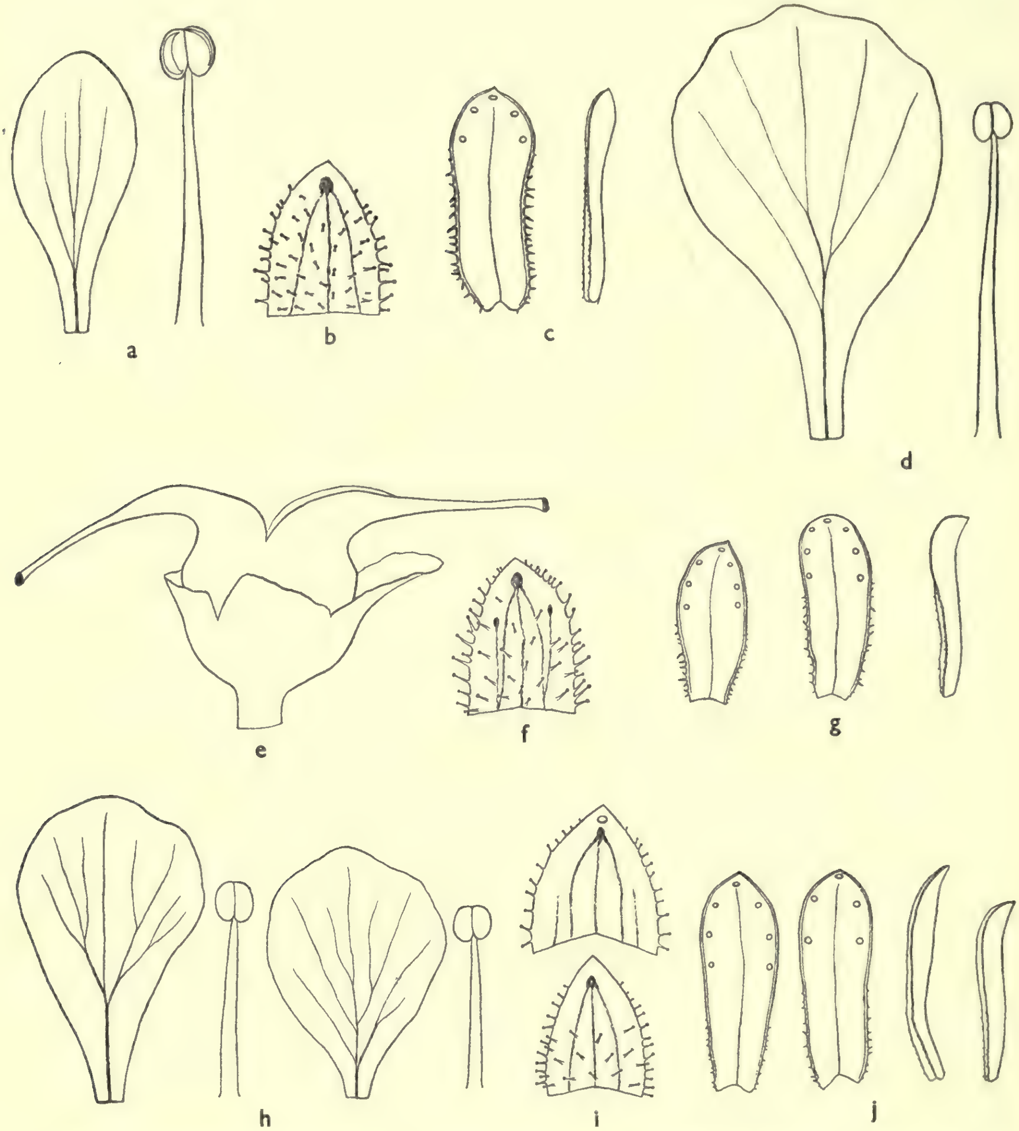


FIG. 6. *Saxifraga nambulana* H. Sm. (holotype) : *a*, petal and stamen ; *b*, sepal ; *c*, leaves seen from above and laterally. *S. buceras* H. Sm. (holotype) : *d*, petal and stamen ; *e*, old capsule ; *f*, sepal ; *g*, leaves seen from above and laterally. *S. elliotii* H. Sm. (holotype) : *h*, petals and stamens ; *i*, inside and back of sepal ; *j*, leaves seen from above and laterally. (All × 5.)

Folia caudiculorum 4–5 mm. longa et 1·5–1·8 mm. lata, modice incrassata, recta vel apice paullo recurvantia, apice subobtusa vel subacuta, apicali dimidia parte glabra et anguste cartilagineo-marginata, c. 7-foveolata, ceterum margine subdense denticulato-ciliata. *Caulis florifer* longe glanduloso-pilosus, foliis caulinis ad 6 mm. longis, lineari-spathulatis, subacutis, apice coriaceis 3–1-foveolatis, ceterum margine dorsoque glanduloso-pilosis. *Hypanthium* subdense glanduloso-pilosum. *Sepala* ovata, subacuta, fere 4 mm. longa et 2·7 mm. lata, margine dorsoque longe glanduloso-pilosa, nervis 3–5 liberis vel sub apicem confluentibus. *Petala* ad 10 mm. longa, 6·5 mm. lata, limbo subovali in unguem fere 3 mm. longum subabrupte angustato, nervis 3 ramosis vel simplicibus. *Stamina* c. 8 mm. longa. *Gynoecium* tertia parte basali indivisum, carpellis in stylos ad 5 mm. longos mox divaricantes angustatis. *Capsula* annotina rotundato-cylindracea, parte indivisa 3·5 mm. longa et 4 mm. crassa, stylis persistentibus horizontaliter patentibus; semina 0·7 × 0·4 mm. magna, sub lente distincte minute papillosa.

S.E. TIBET: Pome, Tongkyuk River, Nambu La, 3,600 m.; on cliff faces; calyx green; corolla yellow; 4 June 1947, *Ludlow, Sherriff & Elliot 13840* (holotype in Herb. Brit. Mus.).

22. **Saxifraga thiantha** H. Sm., sp. nov.

Pulvinatim caespitosa, caudiculis, superne praesertim, imbricatim foliatis; caulis florifer 2–3 cm. longus, laxe 7–10-foliatus; flos solitarius, 12–17 mm. diam. Planta pulcherrima, nullae speciei ante notae arcte affinis.

22a. **Saxifraga thiantha** var. **thiantha.** (Fig. 7 *e–h*.)

Folia caudiculorum 6–7 mm. longa et 1·5–1·7 mm. lata, recta vel modice recurvantia, linearia, apice obtusa, parte basali excepta coriaceo-incrassata, margine anguste cartilaginea, basali dimidia parte denticulato-ciliata, 3–4-foveolata. *Caulis* tota longitudine glanduloso-pilosus, glandulis in vivo rubris; folia caulina sursum decrescentia, apice subacuta vel acuta coriacea glabra 3–1-foveolata, ceterum margine dorsoque glanduloso-pilosa. *Hypanthium* crebre et longe glanduloso-pilosum. *Sepala* triangulari-ovata, acuta, 2·5 mm. longa et 1·5–2 mm. lata, parte apicali (0·5–0·7 mm.) glabra, coriacea, recurvantia, foveola calcium secernenti instructa, ceterum margine dorsoque densiuscule glanduloso-pilosa, nervis 3 in apicem confluentibus vel liberis. *Petala* sulphureo-lutea, 8 mm. longa et 5 mm. lata, limbo rotundato-ovali in unguem c. 1·5 mm. longum sensim attenuata, nervis 5 saepe ramosis. *Stamina* 5 mm. longa. *Gynoecium* semi-superum, c. $\frac{1}{3}$ parte fissum, stylis initio erectis 1–1·5 mm. longis stigmatibus distinctis coronatis. *Semina* 1 × 0·35 mm. magna, minutissime tuberculata.

BHUTAN: Tsampa, Weitang, 4,050 m.; in big clumps of cliff face; corolla yellow; 22 June 1949, *Ludlow, Sherriff & Hicks 19214* (holotype in Herb. Brit. Mus.). Ritang, Tang Chu, 3,900–4,500 m.; growing in huge mossy clumps on cliff faces; corolla, filaments and anthers bright sulphur-yellow; calyx hairy, green, lobes tinged red; scape hairy, each hair with a minute red blob at the end of it; 7 June 1937, *Ludlow & Sherriff 3210*.

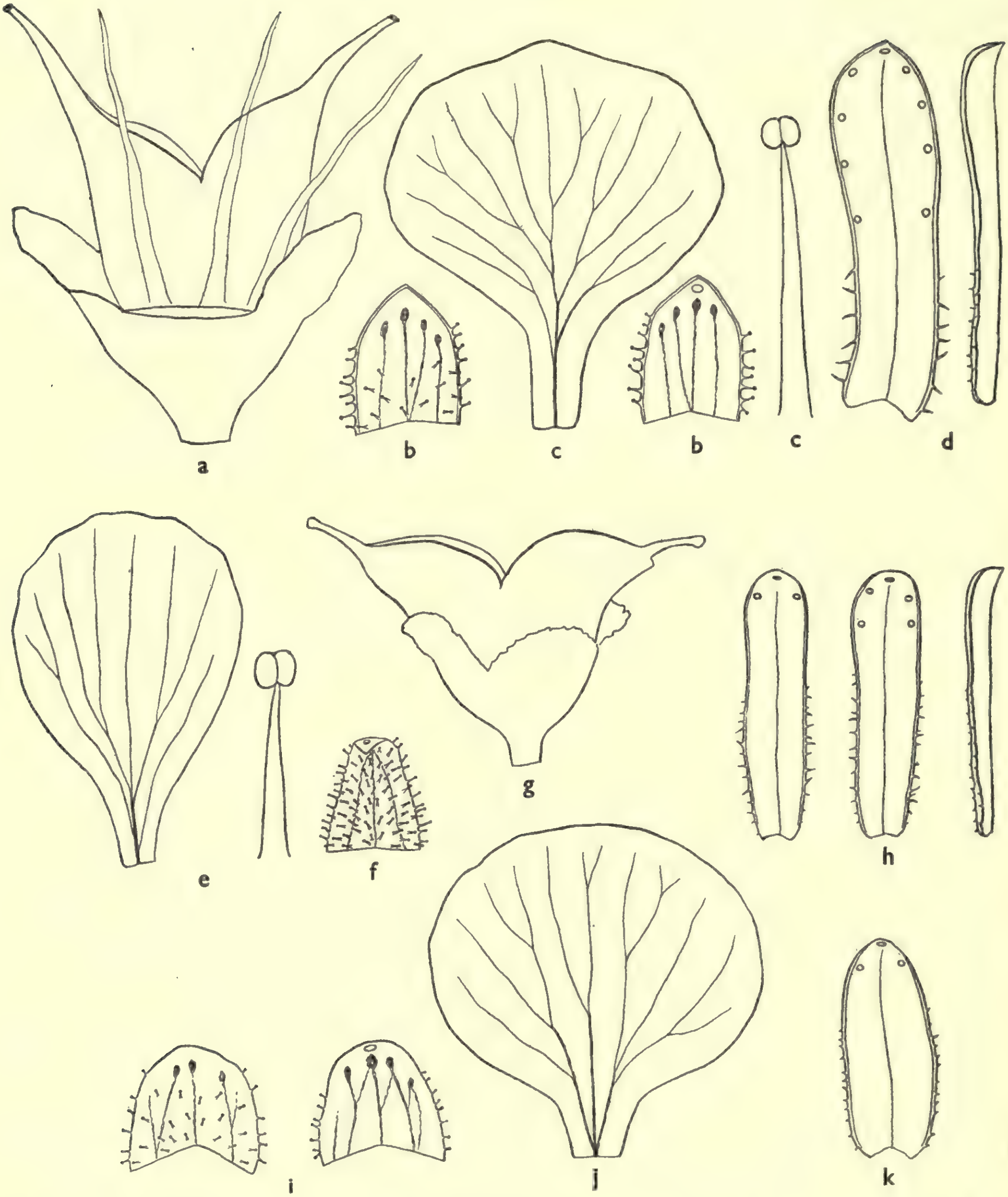


FIG. 7. *Saxifraga kongboensis* H. Sm. (holotype) : *a*, old capsule ; *b*, *b*, sepals, back and inside ; *c*, *c*, petal and stamen ; *d*, leaves seen from above and laterally. *S. thiantha* H. Sm. var. *thiantha* (holotype) : *e*, petal and stamen ; *f*, sepal ; *g*, old capsule ; *h*, leaves seen from above and laterally. *S. thiantha* var. *citrina* H. Sm. (holotype) : *i*, back and inside of sepal ; *j*, petal ; *k*, leaf. (All × 5.)

22*b*. **Saxifraga thiantha** var. **citrina** H. Sm., var. nov. (Fig. 7 *i–k*.)

A var. *thiantha* distat sepalis obtusis, late ovatis, 2·2–2·5 mm. longis et c. 3 mm. latis, apice recto glabris, ceterum margine dorsoque laxiuscule glanduloso-pilosis, glandulis in vivo nigris ; petalis citrinis 8 mm. longis et aequilatis, limbo orbiculari in unguem 1·5 mm. longum abrupte contracto ; foliis caudiculorum c. 5 mm. longis et 2 mm. latis, ciliis marginalibus obtusis (nec acicularibus) et brevioribus.

BHUTAN : Omta Tso, 4,650 m. ; growing in clumps in scree ; calyx tipped russet, covered with black-headed glandular hairs ; corolla pale lemon-yellow ; filaments green, anthers pale yellow ; 11 Aug. 1949, *Ludlow, Sherriff & Hicks 17104* (holotype in Herb. Brit. Mus.).

This variety is probably a local population of the typical plant, though the distinguishing characters are of some consequence. In appearance both plants are perfectly alike.

23. **Saxifraga kongboensis** H. Sm., sp. nov. (Fig. 7 *a–d*.)

Caespites magnos sublaxos formans, caudiculis numerosissimis, ramosis, ad 7 cm. longis et c. 12 mm. diam., subdense foliatis, foliis mortuis longe persistentibus ; caulis florifer ad 2·5 cm. longus, deorsum laxe foliatus ; flores solitarii, lutei, ad 18 mm. diam. Verisimiliter ex affinitate *S. thianthae* H. Sm. sed multo laxius caespitosa et foliosa, foliis et floribus majoribus.

Folia caudiculorum ad 10 mm. longa et 2·5 mm. lata, vix incrassata, linearia vel subobovato-linearia, apice subobtusa, recta vel subrecta, apicali dimidia (vel ultra) parte glabra, c. 9-foveolata, basali parte in margine sparse (ciliis 5–7) sed longe denticulato-ciliata, tota longitudine angustissime cartilagineo-marginata. *Caulis florifer* longe glanduloso-pilosus, foliis caulinis 3–5, superne saepe deficientibus, 1-foveolatis, margine dorsoque glanduloso-pilosis. *Hypanthium* modice glanduloso-pilosum. *Sepala* ovata, subobtusa ad subacuta, recta, c. 3·5 mm. longa et 2·5 mm. lata, foveola calcium secernenti instructa, apicali parte subcoriacea glabra, ceterum margine etiam modice in dorso glanduloso-pilosa. *Petala* 10 mm. longa, 8·5 mm. lata, limbo rotundato margine levissime undulato in unguem 2–2·5 mm. longum abrupte contracto, nervis 5–6 ramosis. *Stamina* c. 7·5 mm. longa. *Gynoecium* fere superum, dimidia parte fissum, stylis fere 3 mm. longis demum divaricantibus. *Capsula* annotina c. 6 mm. alta et sursum ad 6 mm. crassa, tertia parte vel minus divisa ; semina irregulariter ellipsoidea, 0·6–0·8 × 0·25–0·3 mm. magna, obscure minute tuberculata.

S.E. TIBET : Kongbo, Tsangpo Gorge, Shingi Chögyal, 2,850 m. ; on rocks ; corolla yellow ; 7 May 1947, *Ludlow, Sherriff & Elliot 13631* (holotype in Herb. Brit. Mus.).

24. **Saxifraga ludlowii** H. Sm., sp. nov. (Fig. 8 *a–c*.)

Planta caespitosa, caudiculis numerosissimis, ad 8 cm. longis, c. 10 mm. diam., imbricatim foliatis, foliis mortuis longe persistentibus ; caulis uniflorus, 1–1·5 cm. longus, flore magno roseo ad 15 mm. longo. Species insignis ex affinitate obscura.

Folia caudiculorum subobovato-linearia, apice subacuta, 7–10 mm. longa et c. 2·5 mm. lata, margine cartilaginea, apicali parte minute denticulata vel fere levia, ceterum grosse denticulato-ciliata, foveolis 1–4 apici recto vel modice recurvato approximatis. *Caulis* glanduloso-pilosus, 2–3-foliatus, foliis supremis 7 mm. longis et 1 mm. latis glanduloso-pilosis. *Hypanthium* longe glanduloso-pilosum. *Sepala* ovato-triangularia, subobtusa vel subacuta, 5 mm. longa et 3·5 mm. lata, toto margine etiam in dorso glanduloso-pilosa, pilis apicalibus brevioribus. *Petala* 12–14 mm. longa et 6·5–7·5 mm. lata, rhomboideo-spathulata, in unguem indistinctum sensim angustata. *Stamina* petalis duplo breviora. *Gynoecium* semi-inferum, stylis initio erectis, demum divaricatis, c. 4 mm. longis stigmatibus parvis coronatis.

S.E. TIBET: Kongbo, Pasum Chu, Ba La, 4,350 m.; in tufts on boulders; calyx russet; corolla pink; 22 June 1947, *Ludlow, Sherriff & Elliot 13968* (holotype in Herb. Brit. Mus.).

A peculiar plant without obvious affinity with any other species of the section. In full flower it must be a wonderful sight, something like a magnified *S. oppositifolia*.

25. **Saxifraga mira** H. Sm., sp. nov. (Fig. 8 *d–g*.)

E caule lignoso decumbenti ad 12 cm. longo copiose ramosa et pulvinatim caespitosa, caudiculis rigidissimis, fere 10 mm. diam. et ad 10 cm. longis, densissime imbricatim foliatis, foliis rigidis, horizontaliter patentibus, valde incrassatis, longissime persistentibus; caulis florifer pertenuis, 2–3-foliatus, ad 8 mm. longus, uniflorus, flore albo vel roseo. Nullae speciei notae bene comparanda.

Folia caudiculorum 5–6·5 mm. longa et 2–2·5 mm. lata, sublinearia, apice subobtusa vel subacuta, fere tota longitudine subcyclindraceo-incrassata, minute 5–7-foveolata, basali $\frac{1}{3}$ parte modice denticulato-ciliata. *Caulis florifer*, ut *hypanthium*, dense glanduloso-pilosus. *Sepala* late ovata, obtusa, c. 3 mm. longa et lata, margine et basali parte etiam in dorso minute glanduloso-pilosa, nervis 3 ramosis liberis, ut videtur verruculis carentibus. *Petala* ad 7·5 mm. longa et 6 mm. lata, limbo orbiculari in unguem 1·3 mm. longum subabrupte angustato. *Stamina* paullo inaequalia, 3·2–4·5 mm. longa. *Gynoecium* fere omnino superum, alte fissum, stylis erectis c. 4 mm. longis.

NEPAL: Barbung Khola, Kaya Khola, 4,350 m.; forming compact cushions, growing on vertical cliffs, often in shade facing north; flowers bright pink or dull pink to white; 6 June 1952, *Polunin, Sykes & Williams 1094* (holotype in Herb. Brit. Mus.).

26. **Saxifraga poluniniana** H. Sm., sp. nov. (Fig. 8 *h–k*.)

Caespites magnos subdensos formans, caudiculis ramosis, numerosissimis, 10–13 mm. diam., ad 12 cm. longis, densiuscule et superne subimbricatim foliatis, foliis mortuis longe persistentibus; flores albi vel rubescentes, solitarii in caule laxe 3–4-foliato, ad 1·5 cm. longo. Ex affinitate obscura.

Folia caudiculorum patentia, recurvantia, modice incrassata, linearia, apice subacuta, 5–6·2 mm. longa et 1·5 mm. lata, 5–7-foveolata, basali tertia parte sparsim denticulato-ciliata. *Caulis florifer*, ut *hypanthium*, glanduloso-pilosus. *Sepala*

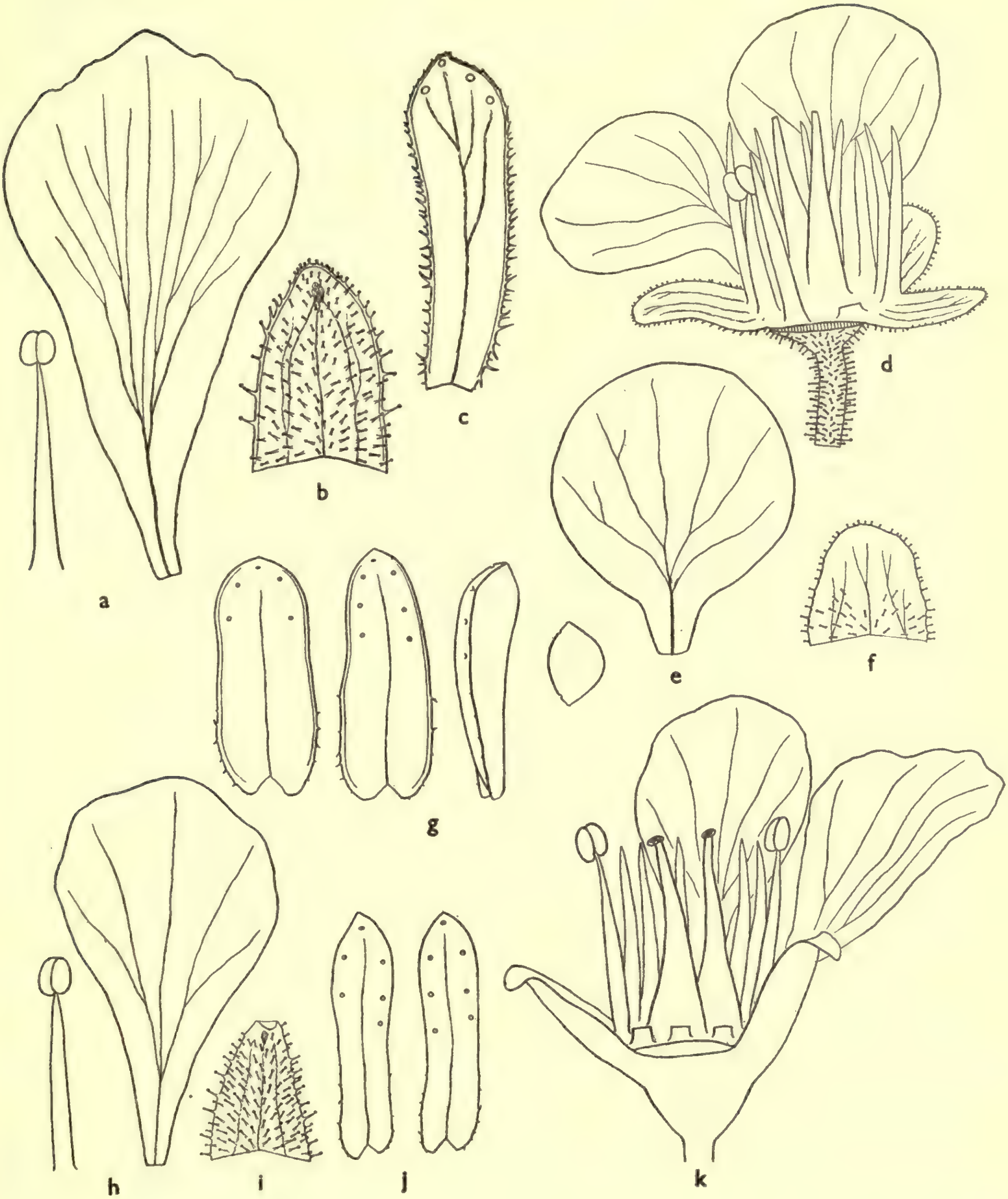


FIG. 8. *Saxifraga ludlowii* H. Sm. (holotype) : *a*, stamen and petal ; *b*, sepal ; *c*, leaf. *S. mira* H. Sm. (holotype) : *d*, flower ; *e*, petal ; *f*, sepal ; *g*, leaves seen from above, laterally and in cross-section. *S. poluniniana* H. Sm. (holotype) : *h*, stamen and petal ; *i*, sepal ; *j*, leaves ; *k*, flower (hairiness not depicted). (All × 5.)

ovata, obtusa, c. 3·5 mm. longa et 2·5 mm. lata, apice glabra recurvantia, ceterum margine dorsoque dense glanduloso-pilosa. *Petala* c. 10 mm. longa et 5 mm. lata, limbo superiore dimidia parte suborbiculari deorsum in basin angustam sensim attenuato. *Stamina* petalis subduplo breviora. *Gynoecium* fere inferum, alte fissum, stylis c. 4 mm. longis.

NEPAL : Between Padmara and Bumra, Padmara Lagna, 3,450 m. ; crevices of vertical rock face beside stream, usually in shade ; leaves pale green with white incrustation ; sepals covered with glandular hairs, reddish-green ; petals white, becoming flushed with pink or even entirely pink in sunlight ; filaments green, reddish towards apex, anthers dark red ; ovaries green, stigmatic tips reddish ; 13 May 1952, *Polunin, Sykes & Williams 4074* (holotype in Herb. Brit. Mus.).

27. **Saxifraga mundula** H. Sm., sp. nov. (Fig. 9 *g–j*.)

Pulvinatim caespitosa, caudiculis 1–2 cm. longis et c. 7 mm. diam., imbricatim foliatis ; caules uniflori, 2–2·5 cm. longi, laxe 7–9-foliati ; flores albi, c. 11 mm. diam. Ex affinitate *S. calcicolae* Anthony[1] a qua inter alia distat foliis caudiculorum rectis basi denticulato-ciliatis (nec glanduliferis), prope apicem 1 (–3)-foveolatis ; sepalis foveola calcium secernenti instructis ; staminibus stylis subaequilongis.

Folia caudiculorum vix incrassata, vulgo recta, ipso apice subobtuso interdum modice recurvantia, linearia, 4–5 mm. longa et 1·5 mm. lata, saepissime uni- (interdum 3-) foveolata, margine fere tota longitudine glabra, anguste cartilaginea, basi solum parum denticulato-ciliata. *Folia caulina* linearia, apice subacuta vel acuta, unifoveolata, margine glanduloso-pilosa, 3–4 mm. longa, 1 mm. lata. *Hypanthium* perbreve, parce glanduloso-pilosum. *Sepala* ovata, subacuta, 3·5 mm. longa et 2·5 mm. lata, apice glabra foveola instructa, margine inferiore majore parte glanduloso-pilosa, dorso glabra, nervis 3 sub apicem confluentibus. *Petala* c. 8 mm. longa et 7 mm. lata, limbo rotundato-truncato in unguem brevem c. 1 mm. longum sensim angustato. *Stamina* c. 5 mm. longa, stylos subaequantia.

S.E. TIBET : Luguthang, below Jalung La, 3,600–3,900 m. ; on rocks in open alpine region ; petals white ; stem and calyx covered with crimson gland-hairs ; 5 June 1935, *Kingdon-Ward 11618* (holotype in Herb. Brit. Mus.).

---

[1] Another new species allied to *S. calcicola* is the following from western China :

Saxifraga saxicola H. Sm., sp. nov. (Fig. 10 *a–d*.)

Pulvinatim caespitosa, caudiculis numerosis, ramosis, ad 3 cm. longis et c. 6 mm. diam., imbricatim foliatis ; caulis uniflorus c. 1·5 cm. longus, laxe 4–5-foliatus, flore albo. Affinis *S. calcicolae* Anthony et *S. saxatili* H. Sm., ab utraque distat caule, foliis caulinis ut calyce pilis eglandulosis instructis ; sepalis truncatis, fere quadrangularibus.

Folia caudiculorum late linearia ad 4 mm. longa et 1·5 mm. lata, apice subobtusa, modice recurvantia, apicali ⅓ parte coriacea glabra foveolis 5–7 instructa, basali ⅔ parte margine denticulato-ciliata. *Folia caulina* 5–6 mm. longa, apicali parte coriacea, unifoveolata, margine et basi etiam in dorso longe ciliata. *Caulis florifer* longe albo-pilosus, pilis rarissime glandula perminuta instructis. *Hypanthium* longe ciliato-pilosum. *Sepala* rotundato-quadrangularia vel fere quadrangularia, 3 mm. longa et 2·5 mm. lata, margine longe ciliata, dorso glabra, nervis 3 simplicibus vel ramosis liberis. *Petala* c. 9 mm. longa et 6 mm. lata, spathulata, limbo in unguem latum c. 2 mm. longum sensim angustato. *Stamina* stylis subbreviora. *Gynoecium* fere ad basin fissum, carpellis sensim in stylos crassos angustatis, partibus liberis 6 mm. longis.

CHINA : Sikang, Kanting (Tatsienlu), mont. orient. prope urbem, in saxo calcifero c. 2,800 m., June 1934, *Rev. H. James* (holotype in Herb. Uppsala : *H. Smith 13681*).

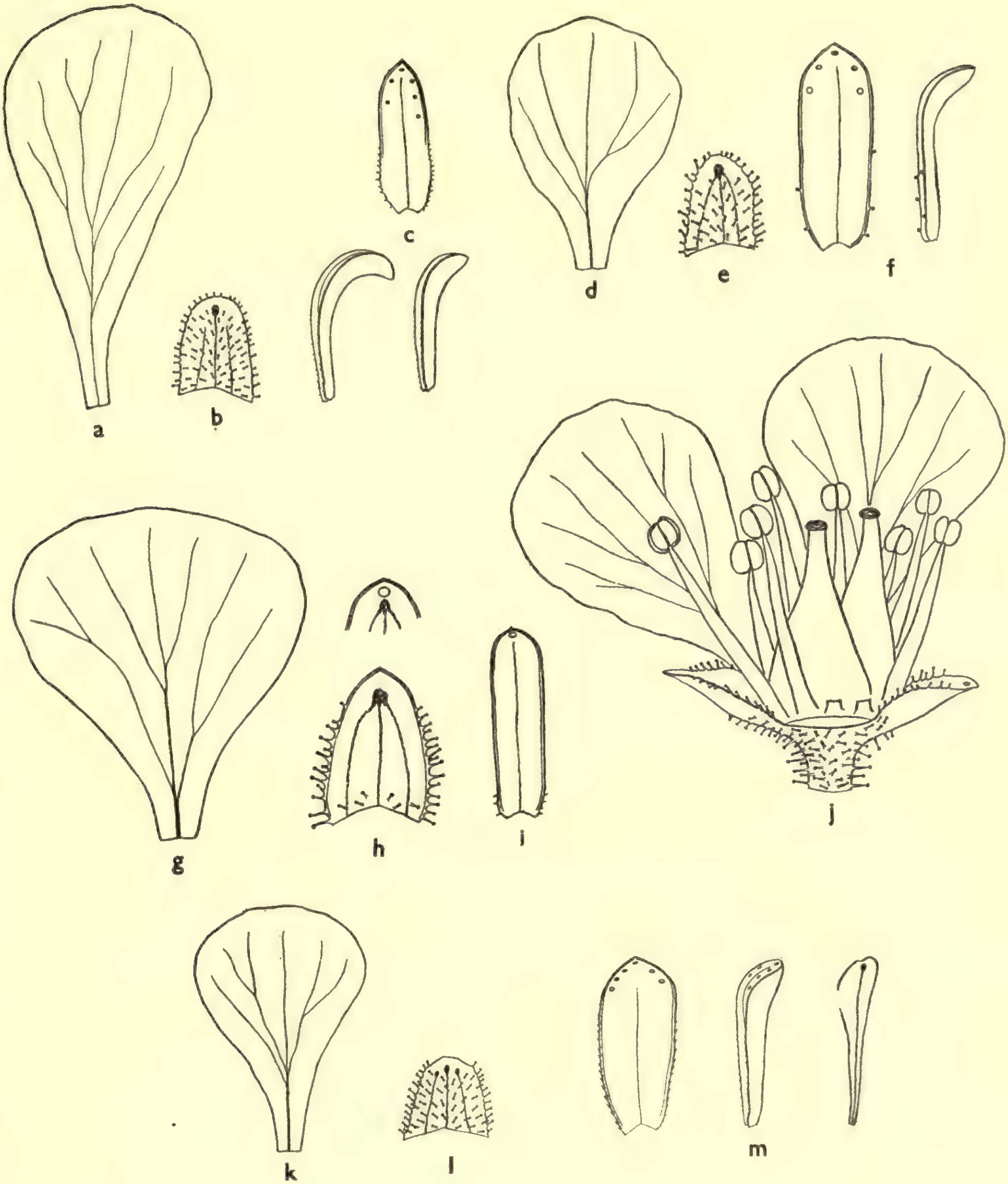


FIG. 9. *Saxifraga lilacina* Duthie (type-coll.) : *a*, petal ; *b*, sepal ; *c*, leaves seen from above and laterally. *S. calcicola* Anthony (type-coll.) : *d*, petal ; *e*, sepal ; *f*, leaves seen from above and laterally. *S. mundula* H. Sm. (holotype) : *g*, petal ; *h*, inside of apex and back of sepal ; *i*, leaf ; *j*, flower. *S. doyalana* H. Sm. (holotype) : *k*, petal ; *l*, sepal ; *m*, leaves seen from above, laterally and in longitudinal section. (All × 5.)

28. **Saxifraga calcicola** Anthony in Not. R. Bot. Gard. Edin. xviii : 32 (1933). (Fig. 9 *d–f*.)

Burma : Nam Tamai valley, 28° N., 97° 45′ E., 2,700–3,300 m. ; an encrusted Saxifraga forming small cushions on rather bare cliffs, not rare ; flowers over ; 10 Sept. 1937, *Kingdon-Ward 13216.*

Not known before outside W. Yunnan.

29. **Saxifraga doyalana** H. Sm., sp. nov. (Fig. 9 *k–m*.)

Dense pulvinata, caudiculis compactis c. 8 mm. diam. et ad 2 cm. longis. *S. lilacinae* Duthie affinis et habitu persimilis sed distat sepalorum apicibus glabris subincrassatis ; petalis albis fere duplo brevioribus ; foliis latioribus, fere rectis, apice valde incrassatis (nec apice modice incrassatis valde recurvatis).

Folia caudiculorum subobovato-linearia, apice subobtusa, ad 4 mm. longa et 2 mm. lata, 5–7-foveolata, apicali tertia parte glabra, valde incrassata, non vel parum recurvata, margine ceterum minute et dense erecto-patenter breviciliolata. *Caulis* uniflorus, c. 1 cm. longus, tenuiter glanduloso-pilosus, laxe 4–5-foliatus. *Hypanthium* tenuiter glanduloso-pilosum. *Sepala* ovata, 1·8 mm. longa et ad basin fere 2 mm. lata, apice glabra, incrassata, saepe foveola instructa, ceterum margine dorsoque dense glanduloso-pilosa, pilis ad 0·2 mm. longis, nervis 3 liberis. *Petala* 6 mm. longa et 4·2 mm. lata, limbo late obovato in unguem c. 1·5 mm. longum sensim angustato. *Stamina* 3–3·5 mm. longa. *Gynoecium* alte fissum, carpellis in stylos 1·5 mm. longos subabrupte angustatis.

S.E. Tibet : Doya La, 4,800 m.; stony ground; white, golden stamens; 8 June 1922, *Everest 1922 Expedition 63* (holotype in Herb. Kew).

30. **Saxifraga staintonii** H. Sm., sp. nov. (Fig. 13 *j–l*.)

Caespites densos suffruticulosos formans, caudiculis rigidis, ramosis, ad 9 cm. longis et c. 13 mm. diam., imbricatim foliatis, foliis cinereis incrassatis suberectis vel patentibus recurvantibus ; caulis uniflorus, ad 5·2 cm. longus, laxe 7–9-foliatus, flore albo c. 10 mm. longo. Habitu *S. micanti* H. Sm. subsimilis, a qua distat caule unifloro, petalis et sepalis multo angustioribus, foliis cinereis (nec argyraceis) apice distincte acuminatis.

Folia caudiculorum sublinearia, apice acuta vel acuminata mucronulata, ad 9 mm. longa et 2 mm. lata, 9–13-foveolata, margine solum in basi paullo dilatata leviter denticulato-ciliata. *Caulis*, ut *hypanthium*, longe glanduloso-pilosus. *Sepala* 4–4·5 mm. longa et basi c. 2 mm. lata, anguste triangularia, apice anguste membranaceo-marginata, margine dorsoque laxe glanduloso-pilosa, nervis 3 sub apicem in verruculam confluentibus. *Petala* anguste obovata, deorsum sensim angustata, c. 10 mm. longa et 4 mm. lata, 5-nervia. *Stamina* c. 4 mm. longa. *Gynoecium* semi-superum, alte fissum, stylis staminibus subaequilongis.

Nepal : Samargaon, north of Tukucha, 4,800 m. ; on steep rocks ; petals and filaments white, anthers yellow ; calyx hairy ; leaves grey-green ; 16 Aug. 1954, *Stainton, Sykes & Williams 7276* (holotype in Herb. Brit. Mus.).

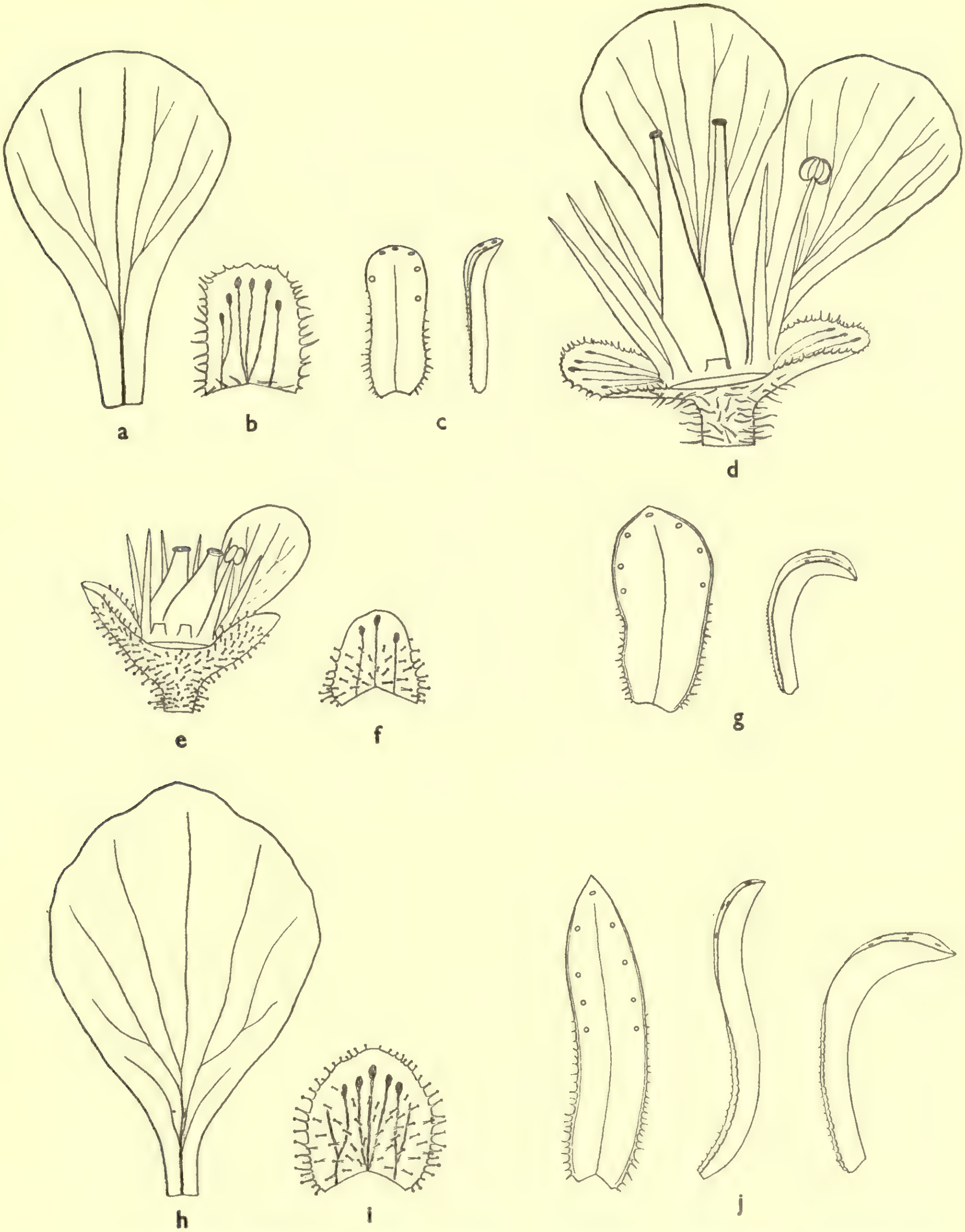


FIG. 10. *Saxifraga saxicola* H. Sm. (holotype) : *a*, petal ; *b*, sepal ; *c*, leaves seen from above and laterally ; *d*, flower. *S. saxatilis* H. Sm. (holotype) : *e*, flower ; *f*, sepal ; *g*, leaves seen from above and laterally. *S. unguipetala* Engler & Irmscher (***Farrer 73***) : *h*, petal ; *i*, sepal ; *j*, leaves seen from above and laterally. (All × 5.)

31. **Saxifraga sherriffii** H. Sm., sp. nov. (Fig. 11 *g–k*.)

Pulvinatim caespitosa, caudiculis rigidis, columniformibus, ramosis, ad 7 cm. longis, imbricatim foliatis, foliis mortuis longe persistentibus ; caulis florifer 3–4·5 cm. longus, laxe foliatus ; flores lutei, 3–7-paniculati, c. 7 mm. longe pedicellati. Verisimiliter *S. ferdinandi-coburgii* Kellerer & Sünderm. (ex Bulgaria) proxime affinis, a qua inter alia distat foliis caudiculorum brevioribus crassioribus emucronatis, caule florifero longe (nec breviter) glanduloso-piloso, petalis longe unguiculatis.

Folia caudiculorum 4 mm. longa et fere 2 mm. lata, incrassata, obovato-ovalia, apice subacuta, apicali $\frac{1}{3}$ parte glabra 5-foveolata modice recurvantia, ceterum in margine dense breviterque denticulato-ciliata. *Caulis florifer* longe glanduloso-pilosus, laxe 7–9-foliatus ; pedicelli pilis tenuibus glanduliferis 0·5–1·1 mm. longis, pilis eglandulosis intermixtis, instructi ; folia caulina infima spathulata, ad 7 mm. longa, 3–1-foveolata, superiora sublinearia efoveolata vel 1-foveolata, omnia margine dorsoque dense glanduloso-pilosa. *Hypanthium* glanduloso-pilosum. *Sepala* ovato-triangularia, acuta, c. 4 mm. longa et 3 mm. lata, margine dorsoque dense glanduloso-pilosa, nervis 5 liberis. *Petala* 7 mm. longa et 5–5·5 mm. lata, limbo late rotundato in unguem 2·5 mm. longum abrupte contracto. *Stamina* 3–3·5 mm. longa. *Gynoecium* semi-superum, alte fissum, stylis gracilibus c. 2 mm. longis.

BHUTAN : Bumthang Chu, Pangotang, 3,750 m. ; cushion plant on cliffs or very steep rocky banks ; corolla bright yellow, getting richer yellow with age ; a fine sight! ; 26 May 1949, *Ludlow, Sherriff & Hicks 18972* (holotype in Herb. Brit. Mus.).

The discovery of this plant in Bhutan is surprising. It is clearly related to the Mediterranean group *Aretioideae*, which extends as far east as the Perim-Dagh mountains of S.W. Bulgaria. Perhaps this group originated in the Himalaya, and not in the Mediterranean region.

Only one yellow-flowered Kabschia was previously known from the Himalayan area : *S. meeboldii* Engler & Irmscher, from Kashmir, a near ally of the Mediterranean *S. kotschyi* Boiss. Both these latter species are characterized by having very short petals, shorter than the stamens.

32. **Saxifraga lamarum** H. Sm., sp. nov. (Fig. 11 *d–f*.)

Pulvinatim caespitosa, caudiculis compactis, imbricatim foliatis, c. 8 mm. diam. ; caulis florifer perbrevis 2–5 (aetate ad 10) mm. longus, 1–3-florus, floribus c. 5 mm. longis, albo-roseis ad intense roseis. Ex affinitate *S. afghanicae* Aitch. & Hemsl., habitu *S. likiangensi* Franch. subsimilis.

Folia caudiculorum 3·5–4·5 mm. longa, ad basin ad 1·8 mm. lata, ovato-linearia, apice acuta incrassata recurvantia, margine apicali dimidia parte glabra, deorsum denticulato-ciliata, 5–7-foveolata. *Caulis florifer* glanduloso-pilosus, laxe foliatus, foliis 3–1-foveolatis, margine et in dorso basin versus glanduloso-pilosis. *Hypanthium* remote glanduloso-pilosum. *Sepala* tenuia, fere membranacea, obscure tincta, 2·3 mm. longa et 1·6 mm. lata, subrectangularia, rotundate obtusa, margine et etiam in dorso inferiore dimidia parte sparse et tenuiter glanduloso-pilosa, nervis 3 in verruculam confluentibus. *Petala* variabilia, obovato-spathulata, 4 mm. longa et 2·7 mm. lata, vel 4·5 mm. longa et 2·2 mm. lata, nervis 3 ramosis vel simplicibus.

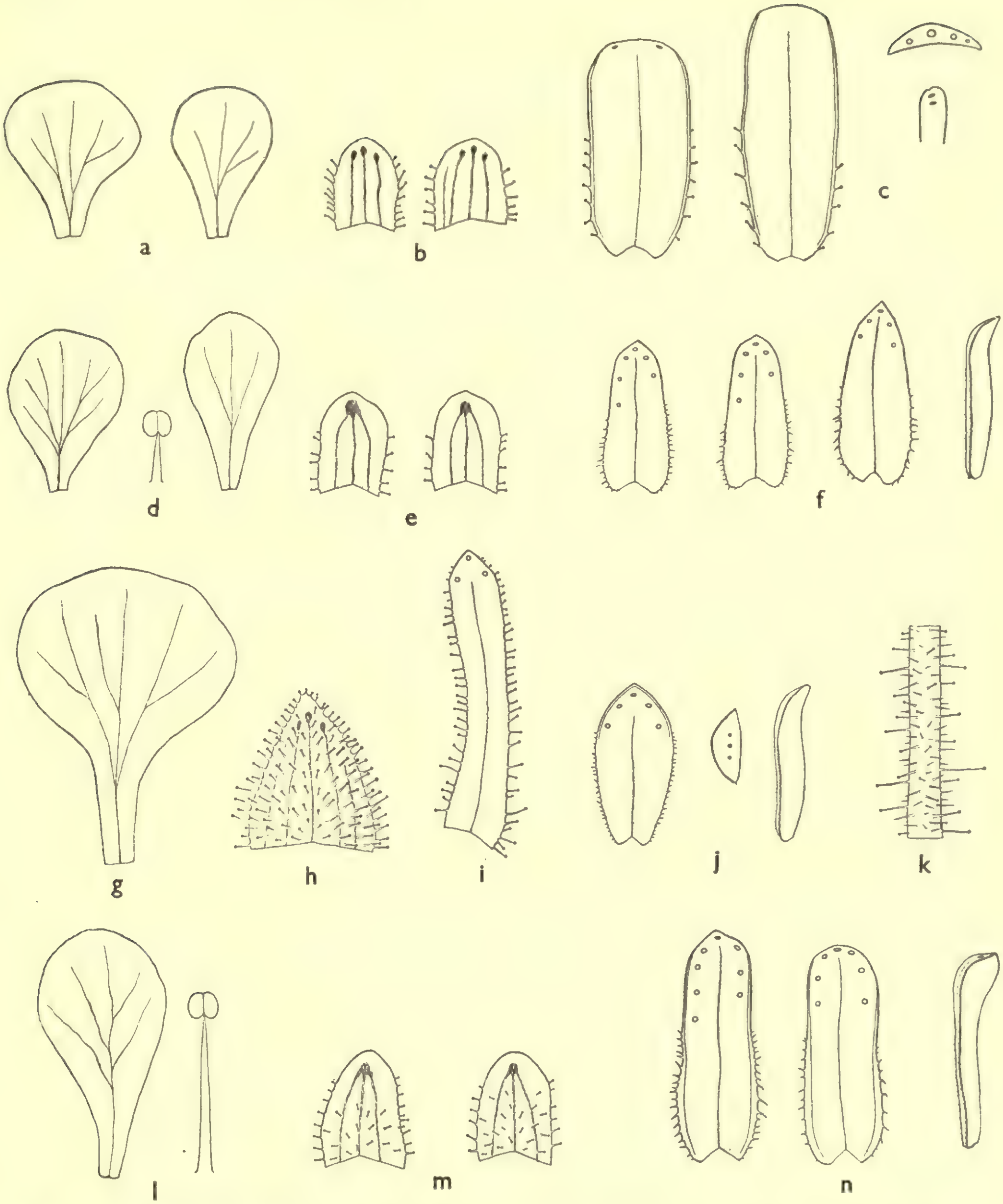


FIG. 11. *Saxifraga clivorum* H. Sm. (holotype) : *a*, petals ; *b*, sepals ; *c*, leaves seen from above, and apex from top and laterally. *S. lamarum* H. Sm. (holotype) : *d*, petals and stamen ; *e*, sepals ; *f*, leaves seen from above and laterally. *S. sherriffii* H. Sm. (holotype) : *g*, petal ; *h*, sepal ; *i*, cauline leaf ; *j*, leaves seen from above, in cross-section and laterally ; *k*, upper part of stalk. *S. afghanica* Aitch. & Hemsl. (*Ludlow & Sherriff 9700*) : *l*, petal and stamen ; *m*, sepals ; *n*, leaves seen from above and laterally. (All × 5.)

Stamina petalis duplo breviora. *Gynoecium* semi-superum, alte fissum, stylis staminibus sublongioribus.

S.E. Tibet : Lhasa, 3,540 m. ; in clumps 10–20 cm. across on cliff faces ; flowers pale pink, some dark and others almost white ; 28 Apr. 1943, *Ludlow & Sherriff 9475* (holotype in Herb. Brit. Mus.).

33. **Saxifraga clivorum** H. Sm., sp. nov. (Fig. 11 *a–c*.)

Caespites densos formans, caudiculis ad 5 cm. longis et ad 9 mm. diam., superne praesertim imbricatim foliatis ; caulis 1–3-florus, florendi tempore perbrevis folia vix superans, demum ad 8 mm. longus. Ex affinitate *S. lamarum* H. Sm., foliis truncato-obtusis (nec acutis), margine glandulosis (nec denticulato-ciliatis), inter alia distincta.

Folia caudiculorum recta, linearia, apice truncato-obtusa, 5–6 mm. longa et 2–2·5 mm. lata, prope apicem incrassatum 3 (–5)-foveolata, margine anguste cartilaginea, sursum glabra, basali dimidia parte glandulis brevistipitatis 5–7 instructa. *Caulis florifer* vulgo dense glanduloso-pilosus ; folia caulina quam ea caudiculorum minora, minus obtusa, margine magis glanduloso-pilosa, 1-foveolata. *Hypanthium* modice glanduloso-pilosum. *Sepala* 2 mm. longa et 1·7 mm. lata, rectangulari-ovata, obtusa, apice glabra, deorsum in margine glanduloso-pilosa, dorso glabra, nervis 3 liberis. *Petala* alba, c. 3·7 mm. longa et 2·4–3·2 mm. lata, limbo subrotundato in unguem brevem indistinctum sensim angustato. *Stamina* c. 2 mm. longa, stylos subaequantia. *Gynoecium* semi-superum, alte fissum, carpellis sensim in stylos breves angustatis.

Bhutan : Dungshinggang (Black Mountain), 3,900–4,200 m. ; growing in tufts on open rocks and cliff faces ; corolla white ; anthers reddish ; 16 June 1937, *Ludlow & Sherriff 3259* (holotype in Herb. Brit. Mus.).

34. **Saxifraga decora** H. Sm., sp. nov. (Fig. 12 *a–d*.)

Habitu *S. lilacinae* Duthie similis, sed minor, caudiculis c. 4 mm. diam. ; caule florifero bifloro, 1–1·5 cm. longo ; foliis caudiculorum minutis, ovalibus, dorso fere rectis ; sepalis margine dorsoque dense et longe glanduloso-pilosis, pilis 0·5–0·8 mm. longis.

Folia caudiculorum lineari-ovalia, apice obtusa, 3 mm. longa et 1·5 mm. lata, fere dimidia parte apicali glabra valde incrassata 5-foveolata, margine deorsum minutissime denticulato-ciliata et anguste cartilaginea. *Caulis florifer* longe glanduloso-pilosus, laxe 5–7-foliatus. *Hypanthium* longe et dense glanduloso-pilosum. *Sepala* ovata, subacuta, c. 2·5 mm. longa et 2·2 mm. lata, apice hyalino-membranacea, margine dorsoque dense et longe glanduloso-pilosa, nervis 3 liberis. *Petala* roseo-lilacina, c. 7 mm. longa et 4 mm. lata, limbo rotundato-obovato in unguem 2·5 mm. longum angustato, nervis 3, lateralibus ramosis. *Stamina* c. 3 mm. longa. *Styli* graciles, 2·5 mm. longi.

S.E. Tibet : Hlo Dzong distr., Kham, 3,900 m ; light dry soil in rock crevices, open country ; grows in form of a moss ; flowers magenta colour ; 12 May 1936, *Hanbury-Tracy 154* (holotype in Herb. Brit. Mus.).

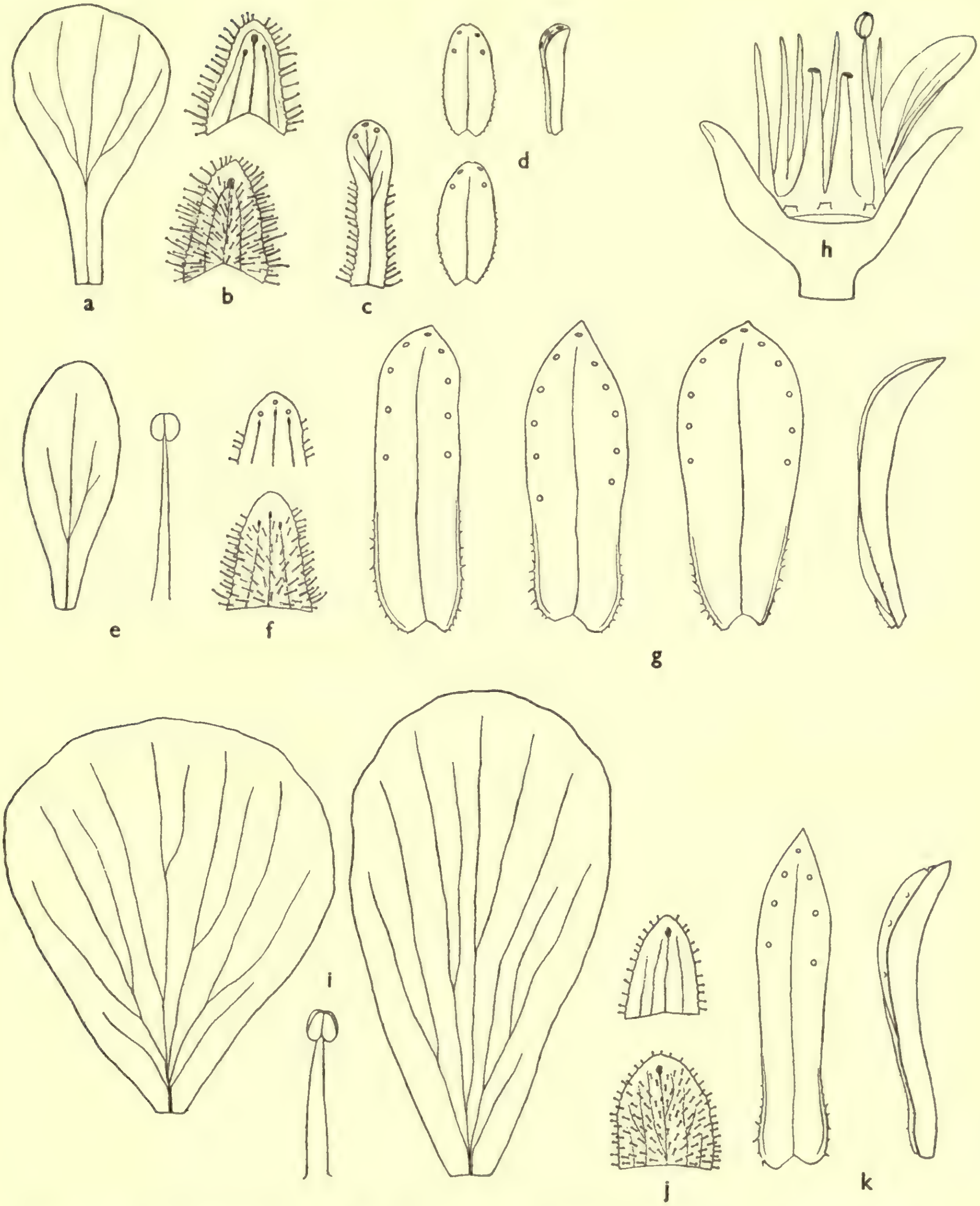


FIG. 12. *Saxifraga decora* H. Sm. (holotype) : *a*, petal ; *b*, inside and back of sepal ; *c*, cauline leaf ; *d*, leaves seen from above and laterally. *S. rhodopetala* H. Sm. (holotype) : *e*, petal and stamen ; *f*, inside of apex and back of sepal ; *g*, leaves seen from above and laterally ; *h*, young fruit (hairiness not depicted). *S. micans* H. Sm. (holotype) : *i*, petals and stamen ; *j*, inside and back of sepal ; *k*, leaves seen from above and laterally. (All × 5.)

35. **Saxifraga rhodopetala** H. Sm., sp. nov. (Fig. 12 *e–h.*)

Pulvinatim caespitosa, caudiculis rigidis c. 13 mm. diam., ad 12 cm. longis, imbricatim foliatis, foliis mortuis longe persistentibus ; caulis florifer 3–4 cm. longus, laxe 5–6-foliatus, floribus 5–9 cymosim dispositis saturate roseis. Ex affinitate *S. afghanicae* Aitch. & Hemsl. et *S. andersonii* Engler & Irmscher ; ab hac distat statura majore, floribus 5–9 (nec 2–4), ab illa floribus multo majoribus roseis ; a duabus foliis acutis, tota longitudine incrassatis.

Folia caudiculorum linearia vel ovato-linearia, apice breviter vel longiuscule acuta, fere ad basin incrassata, margine $\frac{1}{3}$ parte basali denticulato-ciliata, 9–11-foveolata, demum recurvantia ; folia caulina sursum decrescentia, apice glabro 5–1-foveolato, margine dorsoque glanduloso-pilosa. *Caulis*, pedicelli et *hypanthium* dense glanduloso-pilosi. *Sepala* ovata, obtusa, 3 mm. longa et basi 2·3 mm. lata, apice subglabro, foveolis calcium secernentibus 1–3 instructo, margine dorsoque densiuscule glanduloso-pilosa, nervis 3 liberis. *Petala* 6·5 mm. longa et 2·5 mm. lata, limbo ovali in unguem indistinctum angustato. *Stamina* 5 mm. longa. *Gynoecium* semi-inferum, alte fissum, stylis c. 3 mm. longis.

NEPAL : Above Phoksumdo Tal, 3,900 m. ; cliff faces in ravine leading to snow ; rosettes incrusted ; flowers deep rose ; 10 June 1952, *Polunin, Sykes & Williams 2196* (holotype in Herb. Brit. Mus.). Lulo Khola, 4,500 m. ; open, stony slopes and rock ledges ; leaves with white deposit ; flowers over ; roots and seeds collected; 18 Sept. 1952, *Polunin, Sykes & Williams 3472.*

36. **Saxifraga andersonii** Engler [in Engler & Prantl, Nat. Pflanzenfam. iii, 2, a : 59 (1890), *nom. nud.*] Bot. Jahrb. xlviii : 609 (1912) (err. *Anderssonii*). (Fig. 14 *a–g.*)

NEPAL : Langsisa Kharka, 5,100 m., 15 June 1949, *Polunin 386.* Sabze Khola, 3,750–3,900 m. ; deep clumps on rocky hillsides and on river shingles ; flowers white with red centre and calyx, more rarely rosy-pink ; 7 June 1950, *Lowndes 960.* Same locality, 5 June 1950, *Lowndes 943.* Glacier Valley, 3,900 m., 13 June 1950, *Lowndes 982.* 2 miles north of Nahure, 5,550 m., 27 June 1952, *Polunin, Sykes & Williams 39.* Below Kagmara Lagna, 5,250 m., 24 Sept. 1952, *Polunin, Sykes & Williams 3594.* Sisne Himal, 4,950 m., 23 July 1952, *Polunin, Sykes & Williams 238* (broad-leaved form). Barbung Khola, Kaya Khola, 4,350 m., 6 June 1952, *Polunin, Sykes & Williams 1091.* Chaudhabise Khola, 8 miles east of Sialgarhi, 4,350 m., 20 May 1952, *Polunin, Sykes & Williams 981* (partly broad-leaved form). Burchula Lekh, near Jumla, 3,900 m., 14 July 1952, *Polunin, Sykes & Williams 4679* (partly broad-leaved form). Chhairogaon, north of Tukucha, 3,450 m., 1 June 1954, *Stainton, Sykes & Williams 864.* Muktinath Himal, Thinigaon, 4,500 m., 22 June 1954, *Stainton, Sykes & Williams 1279, 1319.* South of Gurjakhani, 3,750 m., 8 June 1954, *Stainton, Sykes & Williams 3072.* Ringmigaon, Phoksumdo Tal, 4,650 m., 21 Sept. 1952, *Polunin, Sykes & Williams 3544.* Near Dogadi Khola, 4,050 m., 29 Sept. 1954, *Stainton, Sykes & Williams 4643* (broad-leaved form). Tegar, north of Mustang, 4,500 m., 8 Oct. 1954, *Stainton, Sykes & Williams 8114.*

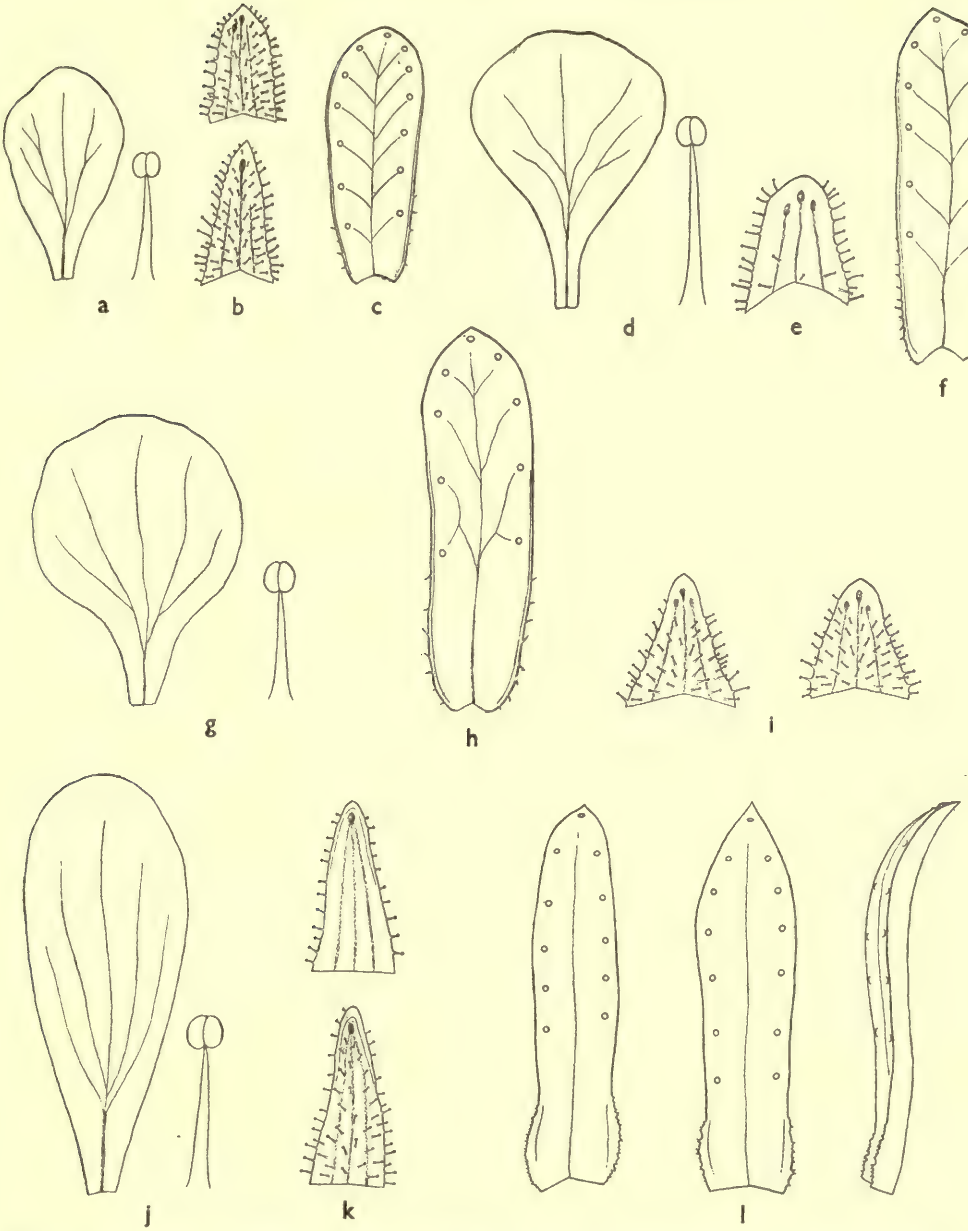


FIG. 13. *Saxifraga stolitzkae* Duthie ex Engler & Irmscher (type-coll.) : *a*, petal and stamen ; *b*, sepals ; *c*, leaf. The same, white-flowered (*Ludlow, Sherriff & Hicks 16398a*) : *d*, petal and stamen ; *e*, sepal ; *f*, leaf. The same, pink-flowered (*Ludlow, Sherriff & Hicks 16398*) : *g*, petal and stamen ; *h*, leaf ; *i*, sepals. *S. staintonii* H. Sm. (holotype) : *j*, petal and stamen ; *k*, inside and back of sepal ; *l*, leaves seen from above and laterally. (All × 5.)

BHUTAN : Dungshinggang (Black Mountain), 4,200 m. ; corolla palest pink or white ; 17 June 1937, *Ludlow & Sherriff 3273*. Gafoola, Upper Pho Chu, 4,350 m., 7 July 1949, *Ludlow, Sherriff & Hicks 16765*. Same locality, 4,200 m., 21 Sept. 1949, *Ludlow, Sherriff & Hicks 17327*. Chesha La, Upper Pho Chu, 4,350 m., 25 Sept. 1949, *Ludlow, Sherriff & Hicks 17283*. Pangte La, Paro Chu, 4,500 m., 14 Oct. 1949, *Ludlow, Sherriff & Hicks 17469*. Between Barshong and Naha, 3,600 m., 14 Oct. 1949, *Ludlow, Sherriff & Hicks 17517*. Barshong, Thimbu Chu, 3,450 m. ; on cliff face ; corolla pinkish-white ; 28 May 1949, *Ludlow, Sherriff & Hicks 16388*. Shingbe, Me La, 4,140 m., 2 July 1949, *Ludlow, Sherriff & Hicks 20787*. Same locality, 4,200 m., 9 July 1949, *Ludlow, Sherriff & Hicks 20716*. Me La, 4,320 m., 8 Sept. 1949, *Ludlow, Sherriff & Hicks 21159*.

Engler's diagnosis must be based on dwarfed specimens. I have not seen any authentic material, but *Dungboo 4560*, from Phari, Chumbi, 1877 (once distributed from Kew as *S. ramulosa*), answers well to the description. According to Engler, the leaves should always be 3-foveolate, as they are for the greater part in the Dungboo specimen. But, in some of the more vigorous caudicles, the leaves have up to 6 pores.

S. andersonii has a wide range of variability. The extremes may look very dissimilar, and, had only a couple of such forms been seen, they could easily have been taken for distinct species.

The petals, described as " rosea " by Engler, are in 16 of the recent gatherings noted as white, in 2 as " palest pink to white ". They vary in length from 3 to 5·5 mm. and in width from 1·5 to 3·5 mm. The sepals are fairly uniform in shape, ovate-linear to ovate-triangular, but their glandular hairiness varies from very dense to sparse. The rosette leaves vary also, probably in accordance with ecological conditions. In plants growing on exposed cliff-faces these leaves are subacute, recurving, 5–7 mm. long by 1·5–2 mm. broad, the 3–7 pores evenly disposed along the margin of the upper third of the leaf. In well-grown specimens the rosette leaves enlarge considerably, up to 8·5 mm. in length and 4 mm. in width, and are broadly cuneate-linear, obtuse, not (or very moderately) recurving ; the somewhat diminished pores may be placed along the subtruncate apex only, not coming down the sides of the leaf. As intermediate stages occur, these broad-leaved forms are presumably of little or no taxonomic standing.

37. **Saxifraga micans** H. Sm., sp. nov. (Fig. 12 *i–k*.)

Pulvinatim caespitosa, caudiculis rigidis, multiramosis, superne imbricatim foliatis, 11–13 mm. diam. et ad 7 cm. longis ; caulis florifer 4–6-foliatus, ad 2·5 cm. longus, floribus 3–4 conspicuis albis et leviter roseo-tinctis. Ex affinitate *S. cinereae* H. Sm. sed distat planta pulvinata, foliis brevioribus acutioribus magis incrassatis, sepalis latioribus, petalis majoribus.

Folia caudiculorum argenteo-micantia, linearia, apice acuta, ad 8·7 mm. longa et 2 mm. lata, apicali dimidia parte valde incrassata 7-foveolata, basali ¼ parte margine modice denticulato-ciliata. *Caulis*, ut *hypanthium*, dense et breviter

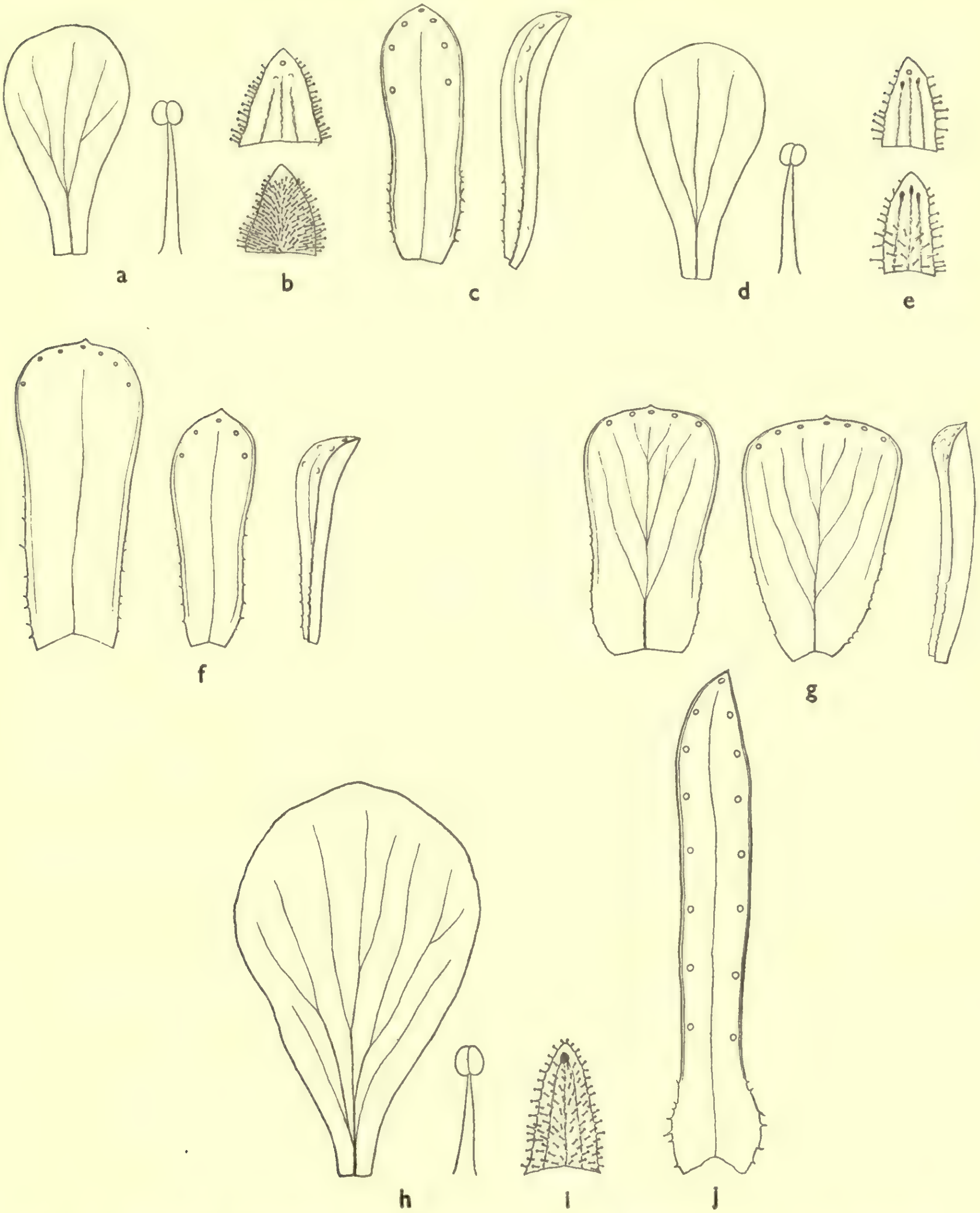


FIG. 14. *Saxifraga andersonii* Engler (*Polunin, Sykes & Williams 1091*, fairly agreeing with original diagnosis) : *a*, petal and stamen ; *b*, inside and back of sepal ; *c*, leaves seen from above and laterally. The same, broad-leaved form (*Polunin, Sykes & Williams 238*) : *d*, petal and stamen ; *e*, inside and back of sepal ; *f*, leaves seen from above and laterally. The same, broad-leaved form (*Polunin, Sykes & Williams 981*) : *g*, leaves seen from above and laterally. *S. cinerea* H. Sm. (holotype) : *h*, petal and stamen ; *i*, sepal ; *j*, leaf. (All × 5.)

glanduloso-pilosus. *Sepala* obtusa, ovata vel late ovata, 3 mm. longa et 1·9–2·5 mm. lata, margine dorsoque breviter glanduloso-pilosa, nervis 4–5 liberis saepe ramosis, nervo mediano solum verrucula instructo. *Petala* obovata vel subrotundata, basi cuneata, 10–12·5 mm. longa, 7–8·5 mm. lata, nervo fere e basi pluriramoso. *Stamina* petalis triplo breviora. *Gynoecium* semi-superum, alte fissum, stylis staminibus subbrevioribus.

NEPAL : South of Gurjakhani, 3,750 m. ; rock faces ; silvery rosettes ; flowers whitish tinged with pink ; 8 June 1954, *Stainton, Sykes & Williams 3074* (holotype in Herb. Brit. Mus.).

38. **Saxifraga cinerea** H. Sm., sp. nov. (Fig. 14 *h–j*.)

Laxiuscule caespitosa, caudiculis ad 5 cm. longis, superne solum imbricatim foliatis et ibi fere 20 mm. diam. ; caulis florifer ad 8 cm. longus, floribus 3–6 subfastigiatim dispositis albis. Ex affinitate *S. micantis* H. Sm., distat foliis longioribus cinereis, floribus minoribus.

Folia caudiculorum sublinearia, apice acuta, margine fere tota longitudine glabra et anguste cartilaginea, basi paullo membranaceo-dilatata et modice denticulato-ciliata, apice solum recurvantia, cinerea, non nitentia, 10–12 mm. longa et 1·5–2 mm. lata, 13–18-foveolata. *Caulis florifer* dense glanduloso-pilosus, c. 5-foliatus, foliis internodiis brevioribus c. 6 mm. longis. *Hypanthium* valde glanduloso-pilosum. *Sepala* ovata, subacuta, 3 mm. longa et 1·5–2 mm. lata, margine dorsoque glanduloso-pilosa, nervis 3 liberis. *Petala* 8–10 mm. longa et ad 6 mm. lata, limbo obovato in unguem indistinctum sensim angustato. *Stamina* 3·5 mm. longa. *Gynoecium* semi-inferum, stylis vix 1·5 mm. longis.

NEPAL : Marsiandi, 2,700 m. ; stony banks and among rocks ; flowers pure white ; stems red and sticky ; leaves grey-green ; 29 May 1950, *Lowndes 916* (holotype in Herb. Brit. Mus.).

39. **Saxifraga afghanica** Aitch. & Hemsl. in Journ. Linn. Soc., Bot. xviii : 56 (1880) ; op. cit. xix : 162, t. 9 figs. 6–12 (1882). (Fig. 11 *l–n*).

NEPAL : Saipal, 4,650 m., 20 Aug. 1954, *Arnold 129.* 3½ miles E. of Saipal, 4,800 m., 31 Aug. 1954, *Arnold 315, 318.*

S.E. TIBET : Hills N. of Lhasa, 4,200 m. : in clumps on rock face ; flowers rose-pink ; 25 June 1943, *Ludlow & Sherriff 9700.*

In the determination key of Engler and Irmscher's monograph (Engler, Pflanzenr. IV. 117 : 560 (1919)) *S. afghanica* comes in under the heading : " Caules floriferi typice uniflori, rarius triflori " ; it is also (fig. 116 F) depicted as one-flowered. The normal condition of the plant is to bear (2–) 3–4 flowers as stated in Aitchinson and Hemsley's diagnosis. There are also other minor divergences in the Engler and Irmscher figures. It is not impossible that these authors may have taken a variety, or even some other species, for true *S. afghanica.*

40. **Saxifraga stolitzkae** Duthie ex Engler & Irmscher in Engler, Pflanzenr. IV. 117 : 569, fig. 116 D (1919). (Fig. 13 *a–i*.)

BHUTAN : Between Barshong and Naha, Thimbu Chu, 3,600 m. ; growing in same cliff as *Paraquilegia* sp., but in wet surroundings ; calyx dark purplish-red ; corolla pink ; 29 May 1949, *Ludlow, Sherriff & Hicks 16398, 16398a.*

The mounted material consists chiefly of a pink-flowered form. With this are a couple of flowering caudicles (now numbered *16398a*) different in several respects. The flowers are white, the stamens longer and the sepals less glandular-hairy. An examination of all the available material indicated that these are extremes in a series of intermediate connecting forms, evidently belonging to the same variable species.

BRITISH MUSEUM
20 MAR 1958
NATURAL HISTORY

THE POLYPODIACEAE AND GRAMMITIDACEAE OF CEYLON

W. A. SLEDGE

BRITISH MUSEUM
NATURAL HISTORY

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 5
LONDON: 1960

THE POLYPODIACEAE AND GRAMMITIDACEAE OF CEYLON

BY

W. A. SLEDGE
(University of Leeds)

BRITISH MUSEUM
- 1 MAR 1960
NATURAL HISTORY

Pp. 131–158 ; 4 *Text-figures*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 5
LONDON : 1960

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series, corresponding to the Departments of the Museum, and an Historical series.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, *No.* 5 *of the Botany series.*

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued February, 1960 *Price Ten Shillings*

THE POLYPODIACEAE AND GRAMMITIDACEAE OF CEYLON

By W. A. SLEDGE

THE families *Polypodiaceae* and *Grammitidaceae* of Holttum's classification—which together constitute the *Polypodiaceae* of Copeland's *Genera Filicum*—are represented in Ceylon by forty-two species. An enumeration of these species, with critical notes on the taxonomy and nomenclature of some of them and comments on their distribution within Ceylon, is given in the succeeding pages. The sequence of genera follows Holttum's *Ferns of Malaya* (1954). Reasons are given for maintaining *Prosaptia* and *Ctenopteris*, and merging *Phymatodes* with *Microsorum*. I have also followed Copeland's *Genera Filicum* and Alston (in Bol. Soc. Brot., Sér. 2, xxx : 21 (1956)) in using *Pleopeltis* in place of *Lepisorus*, which appears to be generically inseparable. Specimens of all gatherings of mine referred to in this paper, including holotypes of the two new species described, will be deposited in the herbarium of the British Museum (BM), and duplicates will be placed in the herbarium of the Royal Botanical Gardens, Kew (K).

PYRROSIA Mirb.

1. **Pyrrosia lanceolata** (L.) Farwell in Amer. Midl. Nat. xii : 245 (1931).

Acrostichum lanceolatum L., Sp. Pl. ii : 1067 (1753).
Niphobolus adnascens sensu Bedd., Handb. Ferns Brit. Ind. : 325, fig. 176 (1883) ; non Kaulf.

A common fern in Ceylon, which is the type locality for Linnaeus's species.

2. **Pyrrosia ceylanica** (Gies.) Sledge, comb. nov.[1]

Niphobolus ceylanicus Gies., Farngatt. Niphobolus : 216 (1901).

Thwaites C.P. 3293 in Herb. Peradeniya bears Giesenhagen's identification, and specimens of the same number in Herb. Brit. Mus. are also without the marginal ciliations on the long-attenuate rhizome scales, the lack of which characterizes the species. *Thwaites C. P. 993* and *Gardner 1153*, as represented in Herb. Kew, Herb. Brit. Mus., Herb. Edinburgh and Herb. Cambridge, are mixtures of *Pyrrosia lanceolata* and *P. ceylanica*, sometimes (e.g. *Gardner 1153* in Herb. Brit. Mus. and *Thwaites C. P. 993* in Herb. Edin.) both species being represented on the same sheet. The relative frequency in Ceylon of this and *P. lanceolata* is not known. I have not collected *P. ceylanica*, but as specimens of it in Herb. Kew and Herb. Brit. Mus. are not notably less numerous than those of *P. lanceolata* it may be inferred that it is not uncommon. It is not confined to Ceylon ; a specimen in Herb. Kew from south India " On trees Courg, Coll. Viscount Gough 3242/105 " is identical with Ceylon specimens.

---

[1] Abeywickrama in Ceyl. Journ. Sci., Sect. A, xiii : 26 (1956), used this combination but did not give it valid publication by reference to its basionym.

3. **Pyrrosia mollis** (Kunze) Ching in Bull. Chin. Bot. Soc. i : 53 (1935).

Niphobolus mollis Kunze in Bot. Zeit. vi : 121 (1848).
Niphobolus sticticus Kunze in Linnaea xxiv : 257 (1851).—Gies., Farngatt. Niphobolus : 135 (1901).
Cyclophorus porosus C. Presl in Abhandl. K. Böhm. Ges. Wiss., Folge 5, vi : 490 (1851).
Polypodium porosum (C. Presl) Mett. in Abhandl. Senckenb. Naturforsch. Ges. ii : 128 (1856).—Hook., Sp. Fil. v. : 48 (1863).
Niphobolus fissus sensu Bedd., Handb. Ferns Brit. Ind. : 330 (1883) ; non Bl.

Kunze described *Niphobolus mollis* from Java and Bali quoting *Zollinger 3183* and *703z*. Ching states that he has examined the types of *N. mollis* and the several other species which he lists as synonyms and that all represent forms of one and the same species. *N. sticticus*, of which there is authentic material at Kew (*Hohenacker 907*), was described by Kunze from the Nilgiris and is certainly the same as the Ceylon plant. There is no specimen at Kew from the Malay Islands determined as *Pyrrosia mollis*, but *Elbert 1598* from Lombok, determined by Posthumus as *Cyclophorus penangianus* (Hook.) C. Chr. (= *P. penangiana* (Hook.) Holtt.), appears to be identical with Ceylon and Indian plants. Backer and Posthumus (Varenfl. Java : 340 (1939)) are certainly incorrect in uniting *P. mollis* with *P. penangiana*.

Pyrrosia mollis was erroneously listed by Manton and Sledge (in Phil. Trans. R. Soc., Ser. B, ccxxxviii : 139 (1954)) as *P. acrostichoides* (Forst. f.) Ching, which is not a Ceylon fern. Hooker (tom. cit. : 44) included Ceylon in the distribution of *P. acrostichoides* on the evidence of a specimen of Gardner's and was copied by Beddome (Ferns Brit. Ind. : t. 81 (1865) but later corrected—by omission—in his *Handbook*), Christensen (Index Fil. : 197 (1905)), Ching (tom. cit. : 69) and Christensen and Tardieu-Blot (in Lecomte, Fl. Génér. Indo-Chine vii, 2 : 514 (1941)). But, as Wall (Cat. Ferns Indig. Ceyl. : 9 (1873)) pointed out long ago, it is unlikely that such a very distinct species would have been overlooked by all other botanists and hence most probable that Gardner's plant came from elsewhere. As there are other instances of doubt regarding the origin of Gardner specimens and as no other gathering of this *Pyrrosia* has been made in Ceylon in the intervening eighty years, Wall's conclusions are strongly reinforced.

Frequent on rocks and trees in the forests of the interior from 500 to 1,500 m.

4. **Pyrrosia gardneri** (Mett.) Sledge, comb. nov.

Polypodium gardneri Mett. in Abhandl. Senckenb. Naturforsch. Ges. ii : 129 (1856).—Hook., Sp. Fil. v. : 51 (1863).—Hook. & Bak., Synops. Fil. : 352 (1867).
Niphobolus gardneri (Mett.) J. Sm., Cult. Ferns : 12 (1857).—Bedd., Handb. Ferns Brit. Ind. : 331 (1883).—Gies., Farngatt. Niphobolus : 145 (1901).
Cyclophorus gardneri (Mett.) C. Chr., Index Fil. : 199 (1905).

A widespread and frequent epiphyte in the Central and Southern Provinces, usually at lower elevations than the preceding, and not ascending above 1,000 m.

5. **Pyrrosia pannosa** (Mett.) Ching in Bull. Chin. Bot. Soc. i : 58 (1935).

Polypodium pannosum Mett. apud Kuhn in Linnaea xxxvi : 141 (1869).—Hook. & Bak., Synops. Fil., ed. 2 : 512 (1874).
Niphobolus pannosus (Mett.) Bedd., Handb. Ferns Brit. Ind. : 328 (1883).—Gies., Farngatt. Niphobolus : 105 (1901).

This is one of a small group of ferns (*Anisocampium cumingianum* C. Presl and *Asplenium formosum* Willd. are others) limited in Ceylon to a relatively narrow tract of country intermediate between the wet and dry zones. It is abundant about the foot of the descent leading from Madugoda to Weragamtota in the Central Province.

DRYMOGLOSSUM C. Presl

6. **Drymoglossum heterophyllum** (L.) Trimen in Journ. Linn. Soc., Bot. xxiv : 152 (1887).—C. Chr. in Dansk Bot. Ark. vi, 3 : 84 (1929).

Acrostichum heterophyllum L., Sp. Pl. ii : 1067 (1753).
Drymoglossum piloselloides sensu Bedd., Handb. Ferns Brit. Ind. : 411 (1883) pro parte ; non C. Presl.

This species was first described by Linnaeus in his *Flora Zeylanica* : 180 (1749), and its type, collected by Paul Hermann in Ceylon, is now in Herb. Brit. Mus.

PLEOPELTIS Humb. & Bonpl. ex Willd.

7. **Pleopeltis nuda** Hook., Exot. Fl. i : t. 63 (1823). (Fig. 1.)

Polypodium nudum (Hook.) Kunze in Linnaea xxiii : 281 (1850) ; non *P. nudum* Forst. f. (1786).—Takeda in Not. R. Bot. Gard. Edin. viii : 277 (1915).
Polypodium wightianum Thw., Enum. Pl. Zeyl. : 394 (1864).
Pleopeltis wightiana (Thw.) Bedd., Ferns S. Ind. : 60, t. 180 (1864).
Pleopeltis linearis Bedd., Handb. Ferns Brit. Ind. : 346 (1883) pro parte ; non *Polypodium lineare* Thunb.
Lepisorus nudus (Hook.) Ching in Bull. Fan Mem. Inst. Biol. iv : 83 (1933).

Takeda was the first to point out clearly the distinction between the Indian *Pleopeltis nuda* and *P. thunbergiana* Kaulf. (*Polypodium lineare* Thunb.) from Japan, Korea, China, Formosa and the Philippines. In *Pleopeltis nuda* the rhizome scales are ovate, acute, entire and brownish, while those of *P. thunbergiana* are subulate-lanceolate, long-acuminate, ciliate-dentate and black. He added that *P. nuda* is also distinguished by having the sori situated " close to the midrib ", but this is not a constant character. Hooker made no reference to the sori as being nearer the midrib than the edge of the frond and his plate shows them as medial in position, as is very often the case. Hooker's description was based on Nepal specimens but the species is widespread in India. In the case of Ceylon specimens the synonyms quoted above cover this and the following species.

Pleopeltis nuda is frequent on rocks and trees in the mountains of Ceylon, whence the following are examples: Nuwara Eliya, *Freeman 321B*, *322* C (BM). Same locality, *G. Thomson* in *Herb. Hooker* (K), and, on same sheet, which is labelled as type specimen, *Gardner 1295*. Oodawella, 1,050 m., 8 Dec. 1950, *Sledge 539*. Corbet's Gap, 1,225–1,325 m., 9 Dec. 1950, *Sledge 561*. Same locality, 7 Jan. 1951, *Sledge 848*. Adam's Peak, 1,525 m., 14 Dec. 1950, *Sledge 604*. Hakgala, 1,675–1,825 m., 16 Dec. 1950, *Sledge 637*. Same locality, 26 Feb. 1954, *Sledge 1220*. Same locality, 20 Mar. 1954, *Sledge 1345*. Hoolankande, 1,375 m., 20 Jan. 1954, *Sledge 1018*. Ramboda Pass, 1,925 m., 17 Mar. 1954, *Sledge 1301*. *Gardner* in *Herb. J. Smith* (BM). *Bradford* in *Herb. Hance 1410* (BM). *Gardner 1139* (K). *Walker 29* and without n. (K).

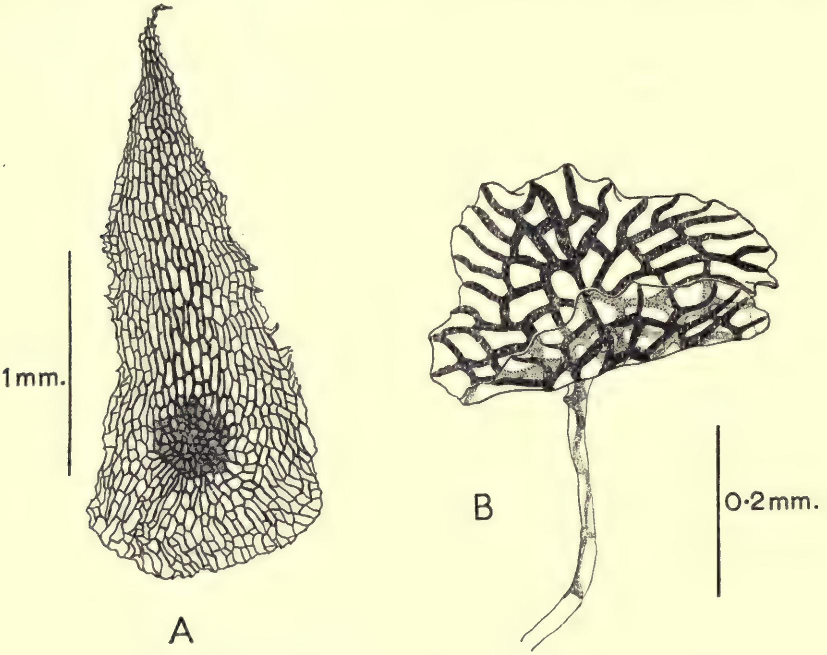


FIG. 1. *Pleopeltis nuda* Hook.: A, rhizome scale; B, sorus scale.

8. **Pleopeltis amaurolepida** Sledge, sp. nov. (Fig. 2.)

Polypodium gladiatum Wall., Numer. List: 10, n. 279 (1829), *nom. nud.*; non *P. gladiatum* Kunze (1834).

Species textura et adspectu generali *P. nudae* Hook. proxime similis sed differt paleis rhizomatis atro-fuscis e basi rotunda peltata breviter acuminatis, discoloribus, linea mediana atro-brunnea, margine dentatis.

CEYLON: Ambagamuwa, 575 m.; on tea bushes; 19 Jan. 1954, *Sledge 999* (BM, holotype). Nuwara Eliya, *Freeman 320* A, *323* D (BM). Castlereagh Estate;

on tea bushes ; 3 July 1927, *Alston 1854* (K). Adam's Peak, 1,525 m., 14 Dec. 1950, *Sledge 604*A. Hunnasgiriya, 875 m., 16 Jan. 1954, *Sledge 970*. Hoolankande, 1,375 m., 20 Jan. 1954, *Sledge 1017*. Corbet's Gap, 1,150 m., 22 Jan. 1954, *Sledge 1026*. Le Vallon, 9 Feb. 1954, *Sledge 1125*. Tonacombe, 1,375 m., 23 Feb. 1954, *Sledge 1182*. Namunukula, 1,525 m., 24 Feb. 1954, *Sledge 1193*. Gongala Hill, 11 Mar. 1954, *Sledge 1266, 1270*. *Thwaites C.P. 1295* (BM). 4 Feb. 1819, *Moon 108* (BM). *Herb. Hooker 1867* (K).

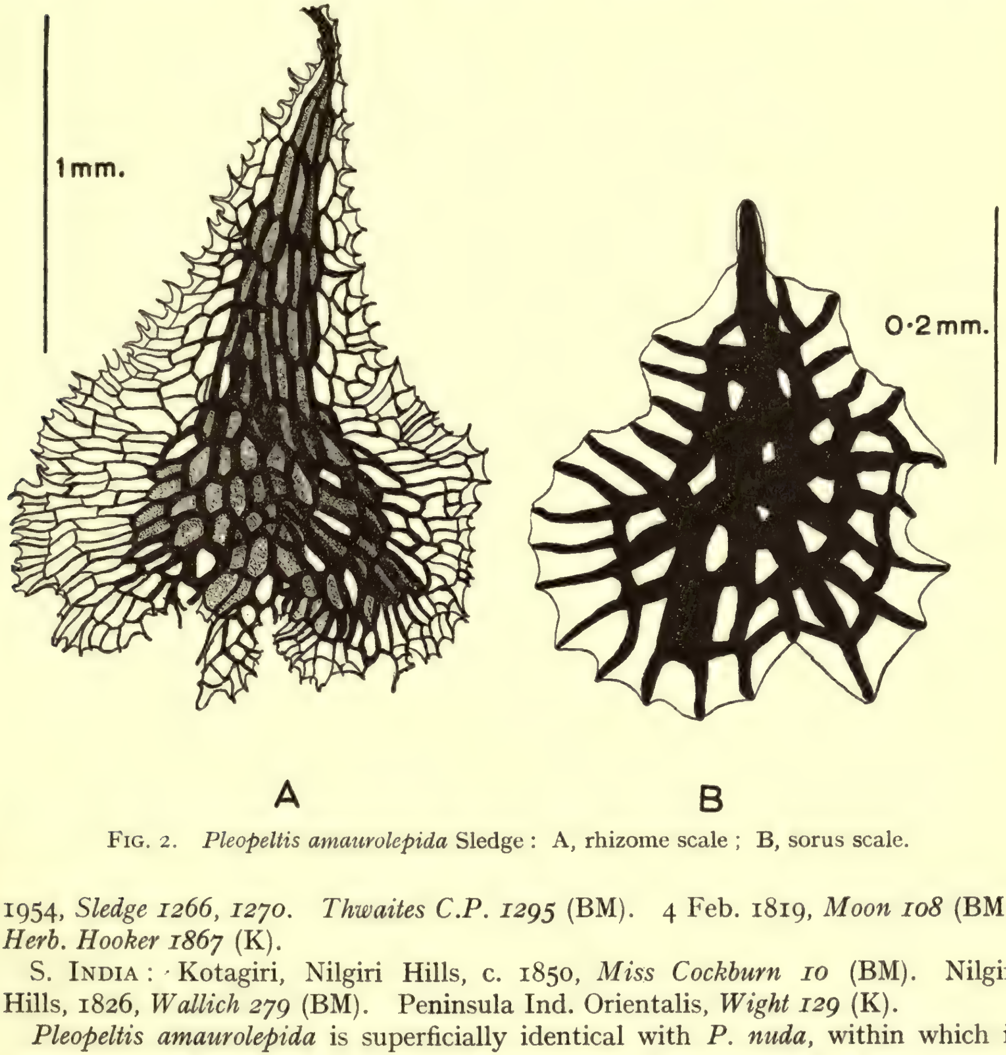


FIG. 2. *Pleopeltis amaurolepida* Sledge : A, rhizome scale ; B, sorus scale.

S. INDIA : Kotagiri, Nilgiri Hills, c. 1850, *Miss Cockburn 10* (BM). Nilgiri Hills, 1826, *Wallich 279* (BM). Peninsula Ind. Orientalis, *Wight 129* (K).

Pleopeltis amaurolepida is superficially identical with *P. nuda*, within which it has previously been included, but the two are readily separable by their rhizome scales. In *P. amaurolepida* the scales are shortly acuminate from the almost orbicular peltate base and their margins are dentate, the teeth being formed as the outer periclinal walls of the irregular marginal cells become deeply concave and leave the heavily thickened anticlinal walls projecting. The cells are larger and their more heavily thickened walls almost black, the cell cavities being clear and transparent save those along the centre of the scale, which are obscured by a blackish-brown coloration. In all these respects the scales contrast markedly with the ovate, acute, concolorous, brown or grey-brown, entire-margined scales of *P. nuda*, as is shown in the accompanying drawings (figs. 1 A, 2 A). There are also slight differences in the peltate scales intermixed with the sporangia, those of *P. amaurolepida* having thicker and darker-coloured walls, but I can find no other constant difference between the two species, and in this respect they are precisely parallel with *P. bicolor* (Takeda) Sledge[1] and *P. excavata* (Willd.) Sledge, which can likewise be distinguished only by their rhizome scales. The scales of *P. amaurolepida* resemble those of *P. thunbergiana* more than those of *P. nuda* in their dark colour, blackened central band, and toothed margins, but those of *P. thunbergiana* are longer and narrower (lanceolate-subulate) in outline.

Pleopeltis amaurolepida differs cytologically from *P. nuda*, having a diploid chromosome number of 74 as against 35. My specimens had not been distinguished from *P. nuda* until attention was redirected to them by Prof. I. Manton's discovery of a fern cytologically different from other samples of *P. nuda* investigated (Manton & Sledge in Phil. Trans. R. Soc., Ser. B, ccxxxviii : 169 (1954)). Re-examination at once revealed the existence of two species readily distinguishable by their rhizome scales though otherwise apparently inseparable morphologically, for both vary considerably in length and breadth of frond according to environmental circumstances. The largest frond on any of my gatherings of *P. nuda* is 40 × 2·5 cm. The largest in *P. amaurolepida* is 30 × 3 cm. The smallest fronds are 6 × 0·7 cm. and 4·5 × 0·5 cm. respectively.

Within Ceylon the two species are probably equally common and widely distributed for, of eighteen gatherings made by me, nine belong to one and nine to the other. The altitudinal range of *Pleopeltis nuda* is 1,050–1,925 m. and that of *P. amaurolepida* is 875–1,525 m. I have seen only three gatherings of *P. amaurolepida* from beyond Ceylon, all of them from southern India.

[PLEOPELTIS EXCAVATA (Willd.) Sledge, comb. nov.

Polypodium excavatum Willd. in L., Sp. Pl., ed. 4, v : 158 (1810).

The above combination is usually attributed to T. Moore, Index Fil. : 347 (1862), on the basis of the following entry under *Drynaria* :

" *phlebodes* Fée.—Pleopeltis excavata ".

This is no more than an indication that he regarded *Drynaria phlebodes* Fée, itself a *nomen nudum*, as a fern to which he intended later in his *Index* to give the name *Pleopeltis excavata*, but there is no more precise indication of the species to which he intended to apply that name than the identity of its epithet with that of *Polypodium excavatum* Willd., which might be no more than a coincidence. His index ceased long before " P ", and no-one seems to have given the combination *Pleopeltis excavata* valid publication subsequently ; it has been quoted only in synonymy.

Takeda (in Not. R. Bot. Gard. Edin. viii : 280 (1915)) includes Ceylon in the

[1] PLEOPELTIS BICOLOR (Takeda) Sledge, comb. nov.

Polypodium excavatum var. *bicolor* Takeda in Not. R. Bot. Gard. Edin. viii : 280 (1915).
Lepisorus bicolor (Takeda) Ching in Bull. Fan Mem. Inst. Biol. iv : 66 (1933).

distribution assigned to this species, but there are no Ceylon specimens so determined by him or Ching in Herb. Kew, Herb. Brit. Mus. or Herb. Edin. It is distinguished by its usually larger and broader fronds of thin texture with the venation evident, and immersed sori forming pustules on the upper surface. The scales are similar to those of *Pleopeltis nuda* but larger, and the rhizome thicker. I have seen no specimen of this from Ceylon and do not doubt that Takeda's citation is erroneous.]

9. **Pleopeltis macrocarpa** (Willd.) Kaulf., Enum. Fil. : 245 (1824).

Polypodium lanceolatum L., Sp. Pl. ii : 1082 (1753) ; non *Pleopeltis lanceolata* Kaulf.
Polypodium macrocarpum Willd. in L., op. cit., ed. 4, v : 147 (1810).
Polypodium marginale Willd., tom. cit. : 149 (1810).
Pleopeltis ensifolia Carm. ex Hook., Exot. Fl. i : t. 62 (1823).
Pleopeltis lanceolata Kaulf., loc. cit. (1824).
Pleopeltis marginalis (Willd.) Kaulf., op. cit. : 246 (1824).
Polypodium lepidotum Willd. ex Schlecht., Adumbr. Pl. : 17 (1825), *nom. illegit.*—Hook., Sp. Fil. v : 56 (1863).
Pleopeltis lepidota Bedd., Ferns S. Ind. : 60, t. 181 (1864), *nom. illegit.*

Although the earliest name applied to this species is *Polypodium lanceolatum*, a combination under *Pleopeltis* based on this name cannot be used because of the prior existence of *Pleopeltis lanceolata* Kaulf., which, although it refers to the same species according to current taxonomic views, was independently described. It has therefore been necessary to adopt one of the two contemporaneous names based on Willdenow species which provide the earliest available epithets. Some authors, e.g. Christensen (Index Fil. : 537 (1906)), regard *Grammitis elongata* Sw. (Synops. Fil.: 22, 213 (1806)) as conspecific with *P. macrocarpa* although subspecifically distinct. Its epithet, however, is not available in *Pleopeltis* because of *P. elongata* Kaulf. (loc. cit.).

This species has been collected only at Ambawella (*Thwaites C.P. 3988*) and Nuwara Eliya. There are no Ceylon specimens in Herb. Kew or Herb. Brit. Mus. Ceylon and the Nilgiri district of south India are its only known stations in Asia. I have been unable to confirm Beddome's statement as to its occurrence in Assam, the only specimen from there so named at Kew being quite certainly not this species. The Indian plants are apparently identical with many American and African specimens.

BELVISIA Mirb.

10. **Belvisia revoluta** (Bl.) Copel., Gen. Fil. : 192 (1947).

Hymenolepis revoluta Bl., Enum. Pl. Jav. ii : 201 (1828).
Gymnopteris spicata sensu Bedd., Handb. Ferns Brit. Ind. : 432 (1883) pro parte ; non C. Presl.

The Ceylon plant is referred by Christensen (Dansk Bot. Ark. vi, 3 : 58 (1929)) to *Hymenolepis revoluta* var. *planiuscula* (Mett.) Hieron. ex C. Chr. (*Taenitis revoluta* var. *planiuscula* Mett., Fil. Hort. Lips. : 28 (1856)), " A weakly characterized variety, scarcely worthy of a name ". Examples from Ceylon are : Nuwara Eliya, *Freeman 384*A, *385*B (BM). Same locality ; on trees ; Sept. 1844, *Gardner 1135* (Herb. Cambridge). Hakgala, 1,675 m., 27 Dec. 1950, *Sledge 739*. Gongala Hill, 1,125 m., 11 Mar. 1954, *Sledge 1257*. *Thwaites C.P. 1303* in part (BM ; K ; Herb. Cambridge). *Robinson* (K).

Beddome's (loc. cit.) account of *Gymnopteris spicata* C. Presl refers not to that species but to both the one under discussion and the next. As his figure does not show rhizome scales it is impossible to determine which of the two species it depicts.

11. **Belvisia mucronata** (Fée) Copel., Gen. Fil. : 192 (1947).

Hymenolepis mucronata Fée, Gen. Fil. : 82, t. 6 B fig. 1 (1852).
Gymnopteris spicata sensu Bedd., Handb. Ferns Brit. Ind. : 432 (1883) pro parte ; non C. Presl.

Thwaites C.P. 1303 in part (K), determined by Christensen as "*Hymenolepis mucronata* f. *longipaleacea* (v.A.v.R.)", has conspicuously toothed scales uniformly black in colour. I have not seen any other Ceylon gathering. This is evidently far rarer than *Belvisia revoluta* throughout the Indo-Malayan region. There is only one other sheet from the India-Malaya region at Kew (*Hose 4846* from Penang, quoted by Christensen in Dansk Bot. Ark. vi, 3:63 (1929)), and only one from Java, whereas there are about 30 sheets of *B. revoluta* from the same area.

LEPTOCHILUS Kaulf.

12. **Leptochilus decurrens** Bl., Enum. Pl. Jav. ii : 206 (1828).—Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 867 (1956).

Anapausia decurrens (Bl.) C. Presl in Abhandl. K. Böhm. Ges. Wiss., Folge 5, vi : 546 (1851).—Copel. in Amer. Fern Journ. xl : 18 (1950).
Gymnopteris decurrens (Bl.) Hook., Garden Ferns : t. 6 (1862) ; non *G. decurrens* Hook. (1857).
Acrostichum variabile Hook., Sp. Fil. v : 277 (1864).—Hook. & Bak., Synops. Fil. : 417 (1868).
Leptochilus zeylanicus Fée, Mém. Fam. Foug. x : 8 (1865).
Gymnopteris variabilis (Hook.) Bedd., Ferns Brit. Ind. : t. 272 (1868) ; Handb. Ferns Brit. Ind. : 429 (1883).
Campium decurrens (Bl.) Copel. in Philipp. Journ. Sci. xxxvii : 351 (1928).
Campium zeylanicum (Fée) Copel., tom. cit. : 352 (1928) quoad syn.
Leptochilus laciniatus var. *simplex* Ching in Bull. Fan Mem. Inst. Biol. iv : 344 (1933) excl. syn. Copel.
Paraleptochilus decurrens (Bl.) Copel., Gen. Fil. : 198 (1947).
Dendroglossa zeylanica (Fée) Copel., op. cit. : 199 (1947) quoad syn.

I have shown (Sledge, loc. cit.) that *Leptochilus lanceolatus* Fée and *L. laciniatus* (Hook.) Ching cannot be maintained as separate species. However distinct they may appear in the herbarium, field studies and observations on plants in cultivation leave no doubt that both are only forms of *L. decurrens*. Fée's type specimens of *L. lanceolatus* show fronds varying from 3 to 5·5 cm. in width. Similarly *L. zeylanicus*, which was based by Fée on *Thwaites C.P. 1317*, is a mere growth form of *L. decurrens*.

In transferring Fée's *Leptochilus zeylanicus* to *Campium*, Copeland confused it with a plant of *L. metallicus* (see below), and when he later referred Fée's species to *Dendroglossa* he was still apparently misinterpreting it in the same manner.

13. **Leptochilus thwaitesianus** Fée, Mém. Fam. Foug. x : 7 (1865).—Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 872 (1956).

Acrostichum lanceolatum Hook., Sp. Fil. v : 276 (1864) pro parte majore ; non *Leptochilus lanceolatus* Fée.—Hook. & Bak., Synops. Fil. : 420 (1868).
Leptochilus laciniatus var. *simplex* Ching in Bull. Fan Mem. Inst. Biol. iv : 344 (1933) pro parte, quoad syn. Copel.

Fée's species was based on *Thwaites C.P. 1316*, which is distinct both morphologically and ecologically from *Leptochilus decurrens* ; it is the plant which Thwaites, Wall and other contemporary Ceylon botanists called *L. lanceolatus*, though Fée's earlier-named *L. lanceolatus* was merely a narrow-fronded form of *L. decurrens*.

14. **Leptochilus wallii** (Bak.) C. Chr., Index Fil. : 388 (1906).—Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 875 (1956).

Acrostichum wallii Bak. in Journ. of Bot. x : 146 (1872).—Hook. & Bak., Synops. Fil., ed. 2 : 523 (1874).
Gymnopteris wallii (Bak.) Bedd., Suppl. Ferns S. Ind. & Brit. Ind. : 26, t. 389 (1876) ; Handb. Ferns Brit. Ind. : 431 (1883).
Campium wallii (Bak.) Copel. in Philipp. Journ. Sci. xxxvii : 348 (1928).
Dendroglossa wallii (Bak.) Copel., Gen. Fil. : 200 (1947).

Only known from the original gathering made by Wall and Hutchinson in 1871 at Deniyaya Gap, Morowakka, Southern Province. A note on the Peradeniya sheet states that the locality has since been destroyed.

15. **Leptochilus metallicus** (Bedd.) C. Chr., Index Fil. : 386 (1906).—Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 876 (1956).

Gymnopteris metallica Bedd., Suppl. Ferns S. Ind. & Brit. Ind. : 26, t. 390 (1876) ; Handb. Ferns Brit. Ind. : 432 (1883).
Campium metallicum (Bedd.) Copel. in Philipp. Journ. Sci. xxxvii : 347 (1928).
Campium zeylanicum Copel., tom. cit. : 352 (1928) pro parte ; non *Leptochilus zeylanicus* Fée.
Leptochilus zeylanicus sensu Ching in Bull. Fan Mem. Inst. Biol. iv : 347 (1933) pro parte ; non Fée.

Endemic to Ceylon and confined to the south and south-west parts of the island. Easily distinguished from the other species by its sessile fronds of rather thick and rigid texture and, when fresh, by the metallic lustre or sheen on the upper surface of the frond.

LOXOGRAMME C. Presl

16. **Loxogramme parallela** Copel. in Perkins, Fragm. Fl. Philipp. iii : 182 (1905).

Loxogramme lanceolata sensu Bedd., Handb. Ferns Brit. Ind. : 392 (1883) ; non C. Presl.

The Ceylon plant matches *Holttum 25504* from Pakka, North Borneo, determined as *Loxogramme parallela* by Christensen, and *Copeland 140* from Luzon. A specimen in Herb. Brit. Mus. of *Zollinger 2953* from Java quoted by Mettenius as *Polypodium loxogramme* Mett. (= *Grammitis lanceolata* Sw.) seems identical with other *L. parallela* specimens and with the Ceylon plant.

The distinctions between this species and *Loxogramme lanceolata* (Sw.) C. Presl are ill-defined, as indeed are those between some other described species in this genus. Commerson and Bojer's specimens from Mauritius and Réunion (Bourbon) referred to in Hooker and Greville's *Icones Filicum* sub t. 43 (1827), which plate I take to represent the true *L. lanceolata*, are in the Kew collection. The fronds are mostly broader than those of Ceylon plants, 1–3 cm. in width, and more or less evenly narrowed to both ends or oblanceolate with the broadest part slightly above the middle. The costa in most fronds is raised on both the upper and lower surfaces and is often grooved in the lower part of the frond. The narrow clathrate rhizome scales have darker cell walls than those of Ceylon and Indian plants but do not otherwise differ. Some Réunion specimens, including some of Bojer's, have markedly oblique and diverging sori, though all Mascarene gatherings are at present placed together as *L. lanceolata* in Herb. Kew and Herb. Brit. Mus. If soral orientation is of real taxonomic value in *Loxogramme*, these cannot belong to *L. lanceolata* in which costal, subparallel sori are diagnostic.

Ceylon plants have narrowly oblong to oblanceolate fronds, 1 cm. broad, the widest part usually—but not invariably—being just below the apex; the costa is evident beneath and well-marked and raised on the upper surface of the frond. The young receptacles are divergent and not parallel with the costa; they are short, the base and apex about on a level with the ends of those below and above them and not overlapping as in *Loxogramme involuta*. When the sori become enlarged by the maturation of the sporangia, they also become confluent to form a line—often broken above and below—which then appears more or less parallel to the costa. Nilgiri specimens often have obliquely diverging sori, the distal ends of which reach half way or more to the frond margin.

Loxogramme parallela is a very rare species in Ceylon. It has been collected on the upper reaches of Pedrotalagala, whence it was distributed by Thwaites as *C.P. 3146*. I collected it there in December 1950, epiphytic on trees at 2,325 m. The only other recorded station in the island is Wattakellie Hill (Ferguson, Ceyl. Ferns: 51 (1880), sub *Gymnogramme lanceolata*).

17. **Loxogramme involuta** (D. Don) C. Presl, Tent. Pterid.: 215 (1836).—Bedd., Ferns S. Ind.: 17, t. 50 (1863); Handb. Ferns Brit. Ind.: 393 (1883).

Grammitis involuta D. Don, Prodr. Fl. Nepal.: 14 (1825).

Common on trees and rocks in the forests of the higher parts of the interior.

MICROSORUM[1] Link

18. **Microsorum membranaceum** (D. Don) Ching in Bull. Fan Mem. Inst. Biol. iv: 309 (1933).

Polypodium membranaceum D. Don, Prodr. Fl. Nepal.: 2 (1825).
Pleopeltis membranacea (D. Don) Bedd., Handb. Ferns Brit. Ind.: 355 (1883).

Common in the forests of the interior from 600 to 1,500 m.

---

[1] This name is usually spelt *Microsorium*, but it was published as *Microsorum* by Link, Hort. R. Bot. Berol. ii: 110 (1833), both on that page and in the Index, and there seems no warrant for treating his spelling as an error.

19. **Microsorum punctatum** (L.) Copel. in Univ. Calif. Publ. Bot. xvi : 111 (1929).

Acrostichum punctatum L., Sp. Pl., ed. 2, ii : 1524 (1763).
Pleopeltis punctata (L.) Bedd., Suppl. Ferns S. Ind. & Brit. Ind. : 22 (1876) ; Handb. Ferns Brit. Ind. : 357 (1883).

A rare fern in Ceylon. *Thwaites C.P. 3799* from Matale East and one other unlocalized gathering (ex *Herb. Robinson*) are the only examples in Herb. Kew and Herb. Brit. Mus. There is also a gathering from between Eratne and Kuruwita (21 Mar. 1927, *J. M. Silva*) at Peradeniya and reference, without specimens, to three other localities whence it has been collected. I found it once only on a tree low down on the Ratnapura side of Adam's Peak.

20. **Microsorum pteropus** (Bl.) Copel. in Univ. Calif. Publ. Bot. xvi : 112 (1929).

Polypodium pteropus Bl., Enum. Pl. Jav. ii, Add. : [3] (1828) ; Fl. Jav., Fil. : 168, t. 76 (1847).
Pleopeltis pteropus (Bl.) Bedd., Handb. Ferns Brit. Ind. : 359 (1883).

The form with small and simple fronds known as *Microsorum pteropus* forma *minor* (Bedd.) Ching (in Bull. Fan Mem. Inst. Biol. iv : 312 (1933)) is the common, and perhaps the only, condition in Ceylon. Beddome (op. cit. : 362) says he never saw three-lobed examples there. *Thwaites C.P. 1301* in Herb. Brit. Mus. and one other recent gathering (*Schmid 1101*) both have small simple fronds. There are no Ceylon specimens in Herb. Kew.

21. **Microsorum dilatatum** (Bedd.) Sledge, comb. nov.

Polypodium dilatatum Wall. [Numer. List : 11, n. 295 (1829), *nom. nud.*] ex Hook., Sp. Fil. v : 85 (1863) ; non *P. dilatatum* Hoffm. (1796).
Pleopeltis dilatata Bedd., Ferns Brit. Ind. : t. 122 (1866).
Polypodium hancockii Bak. in Journ. of Bot. xxiii : 106 (1885).
Polypodium euryphyllum C. Chr., Index Fil. : 525 (1906).
Microsorum hancockii (Bak.) Ching in Bull. Fan Mem. Inst. Biol. iv : 309 (1933).

Although *Polypodium dilatatum* Wall. ex Hook. is an illegitimate name, Beddome's use of its epithet when he transferred the species to *Pleopeltis* was legitimate, and this epithet has priority over *hancockii* ; hence the new combination is necessary.

I have seen only two gatherings from Ceylon : *Thwaites C.P. 3973* from " forests above Telgamma about 4,000 ft." in Herb. Peradeniya, and a specimen from Hoolankande Pass, *Hutchinson* ex *Herb. Robinson*, in Herb. Kew. Ferguson (Ceyl. Ferns : 50 (1880)) states that he has specimens from Rakwane. The Hoolankande specimen agrees well with specimens from north India and China.

22. **Microsorum scolopendria** (Burm. f.) Copel. in Univ. Calif. Publ. Bot. xvi : 112 (1929).

Polypodium scolopendria Burm. f., Fl. Ind. : 232 (1768).
Polypodium phymatodes L., Mant. Pl. Alt. : 306 (1771).
Polypodium alternifolium Willd. in L., Sp. Pl., ed. 4, v : 168 (1810).

Pleopeltis phymatodes (L.) Bedd., Ferns S. Ind.: 57, t. 173 (1864); Handb. Ferns Brit. Ind.: 366 (1883).

Phymatodes scolopendria (Burm. f.) Ching in Contrib. Inst. Bot. Nat. Acad. Peiping ii: 63 (1933).—Holtt., Fl. Malaya ii: 191 (1954).

The large sunken sori serve to separate this and the next species from other *Microsorum* species, and Holttum maintains *Phymatodes* on the ground that when restricted to the type species and immediate allies it seems a very natural group, though the case for its retention seems no stronger than for *Prosaptia*, which he unites with *Ctenopteris*. As Copeland claims that the generic boundaries break down in many species I follow him in uniting *Phymatodes* with *Microsorum*. Cytology affords no evidence for separation.

In Ceylon *Microsorum scolopendria* is a common species at medium to low elevations.

23. **Microsorum nigrescens** (Bl.) Copel. in Occas. Papers Bishop Mus. xiv: 74 (1938).

Polypodium nigrescens Bl., Enum. Pl. Jav. ii: 126 (1828); Fl. Jav., Fil: 161, t. 70 (1847).

Phymatodes nigrescens (Bl.) J. Sm., Ferns Brit. & For.: 94 (1866).—Holtt., Fl. Malaya ii: 193 (1954).

Pleopeltis nigrescens (Bl.) Bedd., Handb. Ferns Brit. Ind.: 367 (1883).

Microsorum alternifolium Copel., Gen. Fil.: 197 (1947) pro parte; non *Polypodium alternifolium* Willd.

As regards Copeland's use of the name *Microsorum alternifolium* (Willd.) Copel. for this species, there are photographs in Herb. Brit. Mus. of Willdenow's type which show a small but fertile frond. No veins are visible in the close-up photograph of the frond, which is unlike *M. nigrescens* in aspect as well as size. Hieronymus has attached a note to the type sheet expressing his opinion that the specimen is a form of *Polypodium phymatodes*. We may therefore safely conclude that *P. alternifolium* Willd. is not the same species as *M. nigrescens* (Bl.) Copel.

Widely distributed and common in the forests of the interior, from 600 to 1,200 m.

DRYNARIA J. Sm.

24. **Drynaria quercifolia** (L.) J. Sm. in Hook., Journ. Bot. iii: 398 (1841).—Bedd., Handb. Ferns Brit. Ind.: 341 (1883).

Polypodium quercifolium L., Sp. Pl. ii: 1087 (1753).

The type is a specimen from Ceylon in Herb. Brit. Mus., collected by Paul Hermann and described by Linnaeus in his *Flora Zeylanica*: 181 (1747). Abundant on trees and rocks in the Central, Western and Southern Provinces up to 900 m.

[DRYNARIA SPARSISORA (Desv.) T. Moore, Index Fil.: 348 (1862).

Polypodium sparsisorum Desv. in Mag. Ges. Naturforsch. Freunde Berl. v: 315 (1811).

Polypodium linnei Bory in Ann. Sci. Nat. v: 464 (1825).—Hook. & Bak., Synops. Fil.: 368 (1868).

Drynaria linnei (Bory) Bedd., Ferns Brit. Ind.: t. 315 (1869); Handb. Ferns Brit. Ind.: 343 (1883).

The reports of the occurrence of this species in Ceylon appear to rest on a single sheet in Herb. Hooker at Kew labelled " Ceylon " but without additional data. The specimen is correctly named. There are no Ceylon or Indian specimens in Herb. Peradeniya or Herb. Brit. Mus. and the only other sheet in the India cover at Kew is labelled " Indian Archipelago. Seeman Dec. 1850, Jan. 1851 " and may well have come from Indonesia. Wall (Cat. Ferns Indig. Ceyl. : 7 (1873)) states that it " is retained here on the faith of specimens found in Ceylon which are considered to be typical ". This statement would seem to imply acceptance of the entry in the *Synopsis* rather than personal knowledge of *Drynaria sparsisora* in Ceylon. Wall evidently did not know the true plant for there is a good specimen of his in Herb. Edin. labelled by him " *Drynaria Linnei* Bory. Hook. Syn. Fil. no. 382" which is unquestionably *D. quercifolia*. As I have been unable to trace any other specimen than the one referred to above, it would seem that the evidence for the occurrence of *D. sparsisora* in Ceylon is inadequate.]

CRYPSINUS C. Presl

25. **Crypsinus montanus** Sledge, sp. nov.

Pleopeltis oxyloba Bedd., Ferns S. Ind. : 59, t. 175 (1864) pro parte ; non *Polypodium oxylobum* Wall. ex Kunze.
Polypodium trifidum sensu Hook. & Bak., Synops. Fil. : 363 (1868) pro parte ; non D. Don.
Pleopeltis hastata Bedd., Handb. Ferns Brit. Ind. : 362 (1883) pro parte ; non *Polypodium hastatum* Thunb.

Species ex affinitate *C. oxylobi* (Wall. ex Kunze) Sledge[1] sed differt frondibus minoribus, lobis paucioribus angustioribus, marginibus remote minuteque indentatis.

Rhizoma repens paleis linearibus ferrugineis c. 5 mm. longis, basi rotundatis peltatis 1 mm. latis, pilo terminatis, marginibus ciliato-dentatis, dense obtectum. *Frondium* stipes 5–15 cm. longus, levis ; lamina 7.5–25 cm. longa, fere aequaliter lata, ovato-deltoidea profunde pinnatifida ad c. 5 mm. ab rhachide, lobis (1–) 2–5-jugis, 5–12·5 cm. longis, 1–2 cm. latis, oblongis, apice acuminatis, plerumque integris aliquando repandis, marginibus crassis remote minuteque indentatis, utrinque glabris, lobis infimis cuneatim decurrentibus, lobo terminali plerumque longiori ; textura firma, nervis principibus subtus manifestis. *Sori* grandes, non impressi, simpliciter uniseriati, inter costam marginemque aequidistantes aut aliquantulum costae propiores.

CEYLON : Adam's Peak, 1,975 m., 14 Dec. 1950, *Sledge 624* (BM, holotype). Same locality, 14 Feb. 1908, *C. G. Matthew* (K). Jungle above Hoolankande, 1,375 m., 20 Jan. 1954, *Sledge 1020* (BM). Jungle above Le Vallon tea estates, 9 Feb. 1954, *Sledge 1108* (BM). Nuwara Eliya, 1,900 m., Apr. 1899, *Gamble 27589*

---

[1] CRYPSINUS OXYLOBUS (Wall. ex Kunze) Sledge, comb. nov.
Polypodium trifidum D. Don, Prodr. Fl. Nepal. : 3 (1825) ; non *P. trifidum* Hoffm. (1790).
Polypodium oxylobum Wall. [Numer. List : 10, n. 294 (1829), *nom. nud.*] ex Kunze in Linnaea xxiv : 255 (1851).
Phymatodes oxyloba C. Presl, Tent. Pterid. : 196 (1836), *nom. nud.*

(K). Same locality, 2,450 m., *Freeman 326* A, *327* B, *328* C, *329* D (BM). Central Province, 1,225 m.; on trees; *T. W. Naylor Beckett 2* (BM). *Thwaites C.P. 3291* (BM). 1871, *Randall* in *Rawson W. Rawson 3225* (BM). 12 Mar. 1819, *Moon 488* (BM). *Walker* (K). *W. Robinson 201* (K). *Herb. J. Smith* ex *Herb. Lambert* (BM).

S. INDIA: Anaimalai Hills, 1,525 m., *Beddome* (original of Beddome, Ferns S. Ind.: t. 175) (K). Nilgiri Hills, *Beddome 99* (K). Sispara, Nilgiri District, 2,125 m., Nov. 1883, *Gamble 13408* (K). Rallia, Nilgiri District, 2,125 m., Oct. 1883, *Gamble 13152* (K). Pykara, Nilgiri District, 1,825 m., June 1883, *Gamble 12092* (K). Same locality; riverside, on trees; June 1908, *Bourne 5122* (K). Nadiwattam, Nilgiri District, 1,825 m., Oct. 1886, *Gamble 18285* (BM; K). Same locality, May 1889, *Gamble 20552* (K). Kotagiri, Nilgiri Hills, c. 1850, *Miss Cockburn 70* (BM). Bear Shola, Kodaikanal, Palni Hills, May 1898, *Bourne 4959* (K). Pillar Rocks stream, Kodaikanal, Palni Hills, June 1898, *Bourne 4960* (K). Palni Hills, 1,700 m., *Saulière 154, 433, 439* (K). Shevaroy Hills, *Faucheux* (BM).

This very distinct species from Ceylon and southern India differs from the Himalayan *Crypsinus oxylobus* (Wall. ex Kunze) Sledge in its smaller fronds, usually not more than 30 cm. high and often less, with fewer and narrower lobes which are in 1–5 pairs, and are 1–2 cm. broad, and have minutely notched margins, and in its inconspicuously ciliate-dentate rhizome scales, the very short teeth of which are formed by excurrent marginal cells. In *C. oxylobus* the lamina of the frond often exceeds 30 cm. and has up to eight pairs of lobes which are normally 1·5–3 cm. broad but may be as much as 5 cm., the margins being always quite entire; the rhizome scales are, when young, conspicuously ciliate with long hairs which are often particularly numerous towards the scale apex.

Clarke (in Trans. Linn. Soc. Lond., Ser. 2, Bot. i: 563 (1880)) pointed out that the Himalayan plant—for which he used the name *Polypodium hastatum* Thunb., with *P. oxylobum* Wall. ex Kunze treated as a variety—is easily distinguished from allied species by its entire leaf margins, though he evidently did not compare them carefully with south India and Ceylon specimens for he included these regions in its distribution. Takeda (in Not. R. Bot. Gard. Edin. viii: 299 (1915)) also emphasized the entire margin of the frond in *P. oxylobum* when pointing out the difference between this and Thunberg's Japanese *P. hastatum*, which also differs in its rhizome scales and simple, trifid or pedate, but never pinnatifid, fronds. Beddome (Suppl. Ferns Brit. Ind.: 96 (1892)) also pointed out that *P. trifidum* D. Don (which is *Crypsinus oxylobus*) is " quite distinct from Thunberg's hastata, with which I united it in my *Handbook* ", but he failed to distinguish the south Indian plant, with which he was more familiar, from that of the Himalaya and accused Clarke of being wrong in saying that it is " always quite entire, my specimens (looked at under a lens) are always more or less toothed " (Handb. Ferns Brit. Ind.: 363 1883)). His illustration in *Ferns of Southern India* (t. 175) was made from a Nilgiri plant and represents *C. montanus*.

All specimens from south India and Ceylon in Herb. Kew and Herb. Brit. Mus. are uniform in the characters detailed above and belong to *Crypsinus montanus*. Kunze had himself confused the two species for, though he described *Polypodium oxylobum* from Himalayan gatherings of Wallich and Hugel, he included Nilgiri specimens collected by Schmid, adding that all Schmid's specimens which he had seen were smaller and trifid. He evidently failed to observe the marginal notches.

The Malaysian *Crypsinus laciniatus* (C. Presl) Holtt. differs in its dark rhizome scales, more numerous frond lobes with slightly toothed margins, and impressed sori.

GRAMMITIS Sw.

26. **Grammitis attenuata** Kunze in Linnaea xxiv : 251 (1851). (Fig. 3.)

Polypodium parasiticum Mett. in Abhandl. Senckenb. Naturforsch. Ges. ii : 36 (1856).—Bedd., Ferns S. Ind. : 55, t. 165 (1864) ; Handb. Ferns Brit. Ind. : 302 (1883) pro parte majore.

Grammitis beddomeana Copel. in Philipp. Journ. Sci. lxxx : 238 (1952) pro parte ; non *Polypodium beddomeanum* Alderw. van Rosenb.

Kunze described this species from Nilgiri specimens. Hooker (Sp. Fil. iv : 167 (1862)) copied Mettenius's description of *Polypodium parasiticum*, which is clearly conspecific with Kunze's species, and cited a Ceylon gathering of Gardner's (*Thwaites C.P. 1283*). Copeland (tom. cit. : 239) comments on the variability of Nilgiri and Ceylon plants in several characters and suggests that more than one species may be included in *Grammitis attenuata* as construed by him.

Seven gatherings from the Nilgiris in Herb. Kew (*C. B. Clarke 11090*A, *11167*, *11195* ; *J. S. Gamble 11503*, *11811*, *13405*, *20505*) from altitudes ranging from 1,625 to 2,600 m. match Kunze's description well and bear out the significant references to " soris elliptico-oblongis subrotundisve ; costae obliquis . . . receptaculum sori placentiforme, tenue, atrum, carbonaceum, ab initio cinctum setis uncatis, demum inter sporangia persistentibus, illis frondis similibus ". Beddome's illustration (Ferns S. Ind. : t. 165) of *Polypodium parasiticum*, made from Nilgiri plants, shows hairs on the upper surface of the frond, elongated receptacles, and long paraphyses or bristles intermixed with the sporangia, which are represented as being non-setose. The description in his *Handbook* (p. 302), " both sides more or less clothed with long hairs, sori often mixed with copious hairs, round or linear ", is also evidently based on plants like the Nilgiri specimens referred to above.

Four of my Ceylon gatherings (*Sledge 706, 733, 758, 1344*), all made in the Nuwara Eliya district at elevations between 1,675 and 2,125 m., are identical with the Nilgiri plants ; and three gatherings made by Freeman (*Freeman 297* A, *298* B, *299* C), on a sheet in Herb. Brit. Mus., also from the Nuwara Eliya district, are the same. Specimens of *Thwaites C. P. 1283* from Pedrotalagala, July 1866, in Herb. Peradeniya, which have been marked " conf. *mediale* Baker ", are *Grammitis attenuata* though specimens of the same number in Herb. Brit. Mus. and Herb. Edin. are *G. medialis*. The rhizome scales in both the Ceylon and Nilgiri plants are dark in colour with black cell walls (fig. 3), differing markedly in this respect from the brown scales of the next species. All these plants clearly represent *G. attenuata*, but a specimen of one of my Nuwara Eliya gatherings (*Sledge 733*) sent to Copeland in 1951 was tentatively referred to *G. beddomeana* (Alderw. van Rosenb.) Copel.

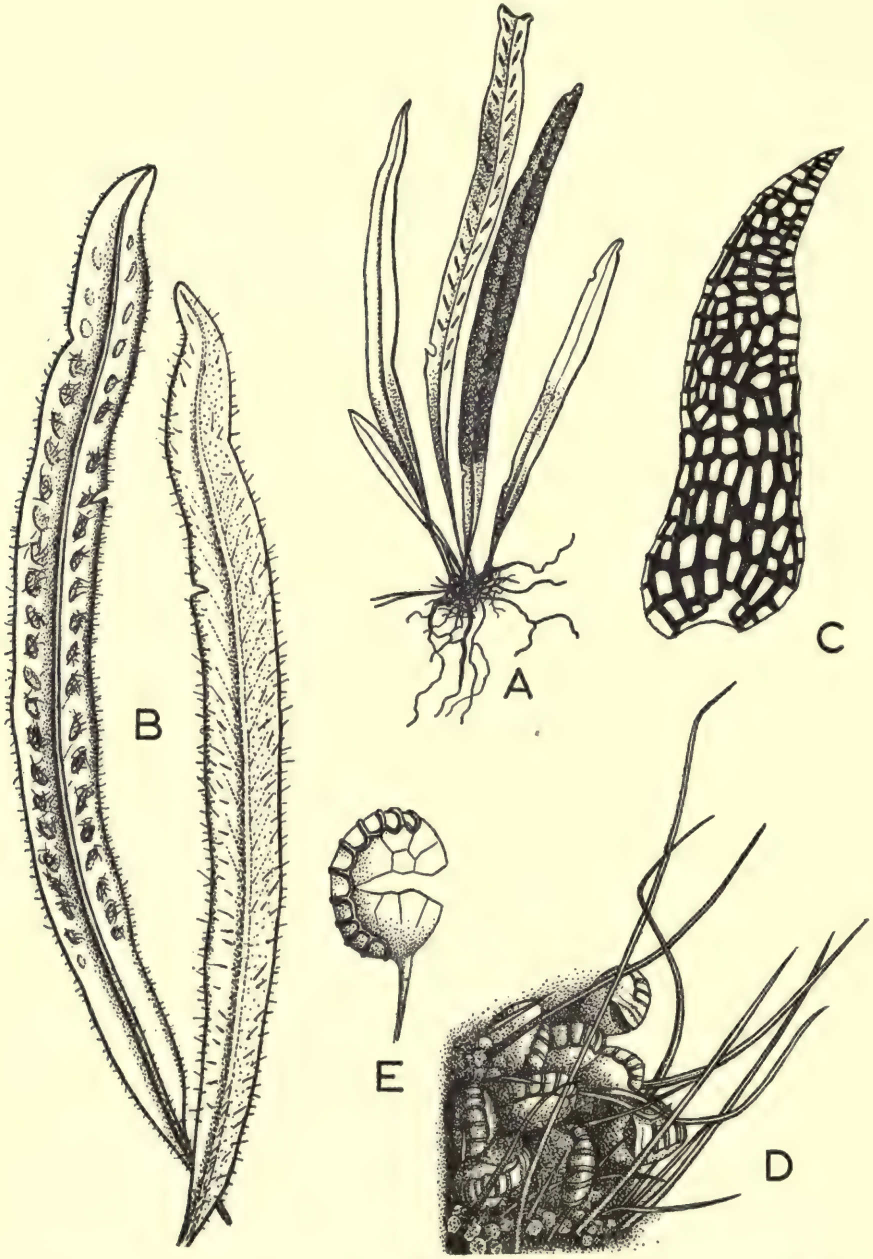


Fig. 3. *Grammitis attenuata* Kunze: A, plant (× ⅗); B, fronds, upper and lower surface (× 1½); C, rhizome scale (× 30); D, sorus (× 40); E, sporangium (× 70).

in his monograph (Copeland, tom. cit. : 238). Wall's plant, however, on which van Alderwerelt van Rosenburgh based his supposed new species came from Bogawantalawa, one of the Ceylon localities for *G. reinwardtii*, of which it is certainly only a small example with simple veins, as is shown by a photograph of the type specimen sent to me by the late Mr. A. H. G. Alston. Beddome's illustrations (Ferns Brit. Ind. : tt. 172, 212 (1866–67)) cited by van Alderwerelt van Rosenburgh as his *P. beddomeanum* do in fact " seem clearly to represent *G. Reinwardtii* " as stated by Copeland under that species. The fronds of my specimens, as in typical *G. attenuata*, are not pellucid in texture, have forked veins, and the sori are medial in position between costa and margin, differing markedly in these respects from *G. reinwardtii*.

The occurrence of both circular and linear sori in the same plant, which has been commented upon by Beddome and Copeland, is due to the spreading of the sporangia which become so disposed as to give a circular or broad-elliptic outline to the mature sorus though the receptacles from which they arise may be elongated or linear in outline. The receptacles themselves, however, vary in shape in this species; sometimes they are broad-elliptic, sometimes quite linear and reaching a length of 2 mm. In old gatherings with over-ripe sori the intermixed paraphyses have often disappeared through breakage. Beddome's statement that he never saw creeping rhizomes in Nilgiri specimens would apply to all—save one specimen—of the Kew gatherings referred to above and also to my Nuwara Eliya plants, in all of which the rhizome is erect. Later, Beddome (Suppl. Ferns Brit. Ind. : 85 (1892)) reversed his earlier statement, saying that the rhizome was " generally creeping though sometimes erect ". This was due to his failure to distinguish between *Grammitis attenuata* and *G. medialis*, for a gathering of his (*Beddome 107* in Herb. Kew) from the Nilgiris, quoted by Hooker as *Polypodium parasiticum*, is a mixture of *G. attenuata* and the following species. A Nilgiri gathering of his in Herb. Brit. Mus. labelled *P. parasiticum* with markedly creeping rhizome, long reddish hairs on the stipes, and broad glabrous fronds with submarginal sori appears to represent an undescribed species.

27. **Grammitis medialis** (Bak.) Sledge, comb. nov. (Fig. 4.)

Polypodium mediale Bak. in Hook. & Bak., Synops. Fil., ed. 2 : 507 (1874).

Polypodium parasiticum sensu Bedd., Handb. Ferns Brit. Ind. : 302 (1883) pro parte minore ; non Mett.

Grammitis attenuata sensu Copel. in Philipp. Journ. Sci. lxxx : 238 (1952) pro parte ; non Kunze.

Baker's *Polypodium mediale* was based on Ceylon specimens received from G. Wall. The sheet in Herb. Kew carries two packets with a letter from Wall dated 23 Apr. 1873 attached to the sheet. One packet contains six specimens, two of which are *Grammitis attenuata*. These two specimens show conspicuous dark brown paraphyses mixed with the non-setose sporangia, dark rhizome scales and fronds with scattered hairs on the upper surface. The other four specimens, in one of which setose sporangia can be seen, have no paraphyses, the fronds are glabrous above, and the rhizome scales are brown. The second packet contains a single specimen

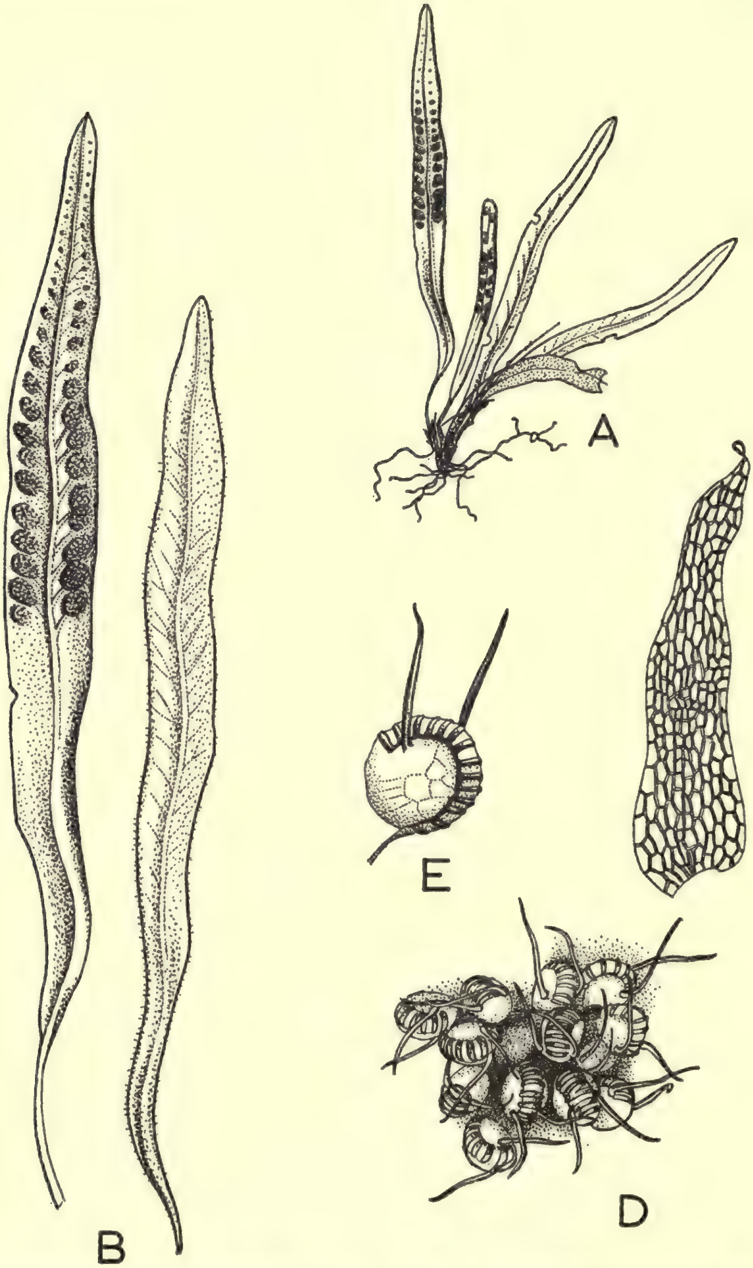


FIG. 4. *Grammitis medialis* (Bak.) Sledge: A, plant (× $\frac{3}{5}$); B, fronds, upper and lower surface (× $1\frac{1}{2}$); C, rhizome scale (× 25); D, sorus (× 25); E, sporangium (× 50).

with glabrous fronds, strongly setose sporangia without intermixed paraphyses, and brown rhizome scales. In the letter attached to the sheet Wall states that from his own sheet he has " taken off three plants which I enclose ". Additional specimens have therefore been added to those originally received from Wall on which Baker founded his new species. It is probable that three of the specimens which are markedly darker in colour and presumably older than the rest represent the original specimens sent by Wall, and these three specimens are all glabrous above and have brown rhizome scales. That the two plants of *G. attenuata* were not amongst the original specimens received may also be inferred from the reference in Baker's description to the " pale brown " rhizome scales and the frond surfaces with " obscure short brown hairs ". Wall (Cat. Ferns Indig. Ceyl. : 7 (1873)) states that the specimens came from Hoolankande, where I have myself collected brown-scaled, glabrous-fronded and setose-sporangiate plants. My own specimens from Hoolankande have the most conspicuously elongated receptacles of any gathering of this species and agree well in this respect with Baker's description, though he was at fault in describing the sori as nearer to the edge of the frond than the midrib. The two specimens of *G. attenuata* on Baker's sheet have now been separated from the remaining specimens, which have been designated as type of *G. medialis*.

This second species of *Grammitis* superficially similar to *G. attenuata* is widely distributed in Ceylon at lower elevations. It differs from that species in its brown rhizome scales and in its fronds' being normally glabrous above or at most with a few hairs on the midrib and more rarely near the margin, such hairs when present being much shorter than those of *G. attenuata*. The receptacles are usually circular or broad-elliptic and the sporangia are setose, often strongly so, and without intermixed paraphyses (fig. 4). My five gatherings of this species (*Sledge 596, 702, 1021, 1043, 1281*) were made in widely separated localities in the Central and Sabaragamuwa Provinces and at various elevations from 425 to 1,675 m. In three of these gatherings the rhizomes are erect, in the other two they are creeping, the longest reaching a length of 3 cm. Two Ceylon collections in Herb. Kew, viz. *Naylor Beckett 4* with rhizomes both creeping and erect, and *Gardner 1283* with creeping rhizomes, represent the same species. In Herb. Brit. Mus. there are three collections, two of them solitary specimens (*Thwaites C.P. 1283* and another unlocalized plant in *Herb. John Smith*) and a third in *Herb. H. F. Hance* collected by G. Wall " circa Rambodde alt. 4–5,000 ft." All of these gatherings have brown rhizome scales, glabrous upper surfaces to the fronds, and setose sporangia without intermixed bristles or paraphyses. The degree to which the setae are developed on the sporangia is variable and they become obsolete in old sori with empty dehisced sporangia.

The true *Grammitis attenuata* is so distinct that Kunze founded on it a subgenus *Trichothemalium* based on the characteristic and conspicuous receptacular bristles. There is nothing in Copeland's discussion of the gatherings examined by him to show that any of these were the true high-level Nilgiri and Ceylon *G. attenuata*. But old material might well have failed to show the essential soral differences, and his significant admission that " Either this is a variable species, in the rhizome, shape of frond, and setulae, or I am confusing more than one species " strongly suggests that the material included some specimens of the true plant but was too inadequate in quality to demonstrate clearly the differences. Copeland adds that if more than one species was included, Baker's *Polypodium mediale* might be the other. There is no doubt that his description under *G. attenuata* of the Nilgiri plant (*Perrotet 1490*) with creeping rhizome and sporangial setae and of Ferguson's Ceylon plants refers to *G. medialis*, and that the two species are quite distinct.

The characters of *Grammitis attenuata* and *G. medialis* may be contrasted as follows :

G. attenuata

Rhizome erect with tufted fronds, scales dark-coloured, their cell walls black ; fronds coriaceous, clothed above with scattered long dark brown or black hairs ; receptacles broad-elliptic to linear, sporangia without setae, mixed with conspicuous long dark-coloured bristles or paraphyses.

G. medialis

Rhizome erect or creeping, scales brown ; fronds subcoriaceous, glabrous above or with a few short hairs on the midrib ; receptacles circular to elliptic, sporangia more or less setose, often strongly so, without intermixed paraphyses.

28. **Grammitis zeylanica** Fée, Gen. Fil. : 234 (1852).

Polypodium zeylanicum (Fée) Mett. in Abhandl. Senckenb. Naturforsch. Ges. ii : 38 (1856).—Hook., Sp. Fil. iv : 169, t. 272 B (1862).—Bedd., Ferns S. Ind. : 78, t. 237 (1864) ; Handb. Ferns Brit. Ind. : 303 (1883).

The undulate margins of the fronds and glaucous green colour are characteristic of this species. Fée described the fronds as 15–17 cm. long and Copeland (in Philipp. Journ. Sci. lxxx : 240 (1952)) as up to 20 cm., which is correct for most examples, but I have a specimen in which they exceed 30 cm. My specimens from the Nuwara Eliya district, Knuckles Hill near Kandy, Le Vallon and Adam's Peak were all collected between 1,525 and 1,975 m., but the species ascends still higher about Nuwara Eliya.

29. **Grammitis wallii** (Bedd.) Copel. in Philipp. Journ. Sci. lxxx : 240 (1952).

Polypodium wallii Bedd., Suppl. Ferns S. Ind. & Brit. Ind. : 20, t. 380 (1876) ; Handb. Ferns Brit. Ind. : 305 (1883).

This species was only known from collections made in May 1866 on Adam's Peak, and in July 1868 at Gongala Hill, Southern Province, from which stations there are specimens in Herb. Kew, both numbered *Thwaites C.P. 3921*. In Herb. Brit. Mus. there are specimens of *Thwaites C.P. 3921* from Gongala Hill, and in the Peradeniya collection there is one sheet only, also from Gongala Hill and dated July 1868. *Grammitis wallii* does not appear ever to have been collected again until Dr. T. G. Walker and I refound it on a mossy rock-face in jungle at Gallebodde Rock, Central Province, at 1,225 m., on 27 Jan. 1954. The specimens match well the original gatherings. Beddome's description and figure overemphasize the thickness of the frond. In both the Herb. Brit. Mus. and some of the Peradeniya specimens the venation is visible through the thickness of the mounting-paper when the sheets are held up to the light for examination.

30. **Grammitis reinwardtii** Bl., Enum Pl. Jav. ii, Add.: [2] (1828); Fl. Jav., Fil.: 114, t. 48 fig. 1 (1830).

Polypodium lasiosorum sensu Bedd., Ferns Brit. Ind.: t. 172 (1866); non Hook.
Polypodium hirtellum sensu Bedd., op. cit.: t. 212 (1867); Handb. Ferns Brit. Ind.: 305 (1883); non Bl.
Polypodium beddomeanum Alderw. van Rosenb. in Bull. Jard. Bot. Buitenz., Sér. 2, xxviii: 39 (1918).

Polypodium beddomeanum was based on *Wall 30* from Ceylon. The type specimen in Herb. Bogor has lately been examined and photographed by the late Mr. A. H. G. Alston. Van Alderwerelt van Rosenburgh was correct in referring it to the species illustrated by Beddome (Ferns Brit. Ind.: tt. 172, 212 (1866–67)) and in pointing out that the illustrations represent neither Hooker's *P. lasiosorum* nor Blume's *P. hirtellum.* He was not correct, however, in stating that it was " also not P. reinwardtii *Pr.*" nor did he explain how it differs specifically from that species. The single specimen of Wall's on which van Alderwerelt van Rosenburgh founded his supposed new species seems identical with the plant illustrated by Beddome (t. 172) as *P. lasiosorum.* Later (t. 212) Beddome stated that " copious specimens from Mr. Thwaites from Ceylon clearly show that the two forms belong to one species ". The illustration of *P. lasiosorum* was made from a plant collected at Bogawantalawa. No locality is given on the label accompanying Wall's specimen but, as the only station he cites for *P. hirtellum* in his *Catalogue of Ferns Indigenous to Ceylon* (1873) is Bogawantalawa, he evidently collected his own specimens there. This locality is one of the few known stations in Ceylon for *Grammitis reinwardtii* and there is no doubt that Wall's specimen, like that shown in Beddome's first illustration, was merely a small example of that species with undivided veins.

Copeland (in Philipp. Journ. Sci. lxxx: 236 (1952)) correctly referred Beddome's illustrations to *Grammitis reinwardtii* and quoted a Ceylon specimen of Trimen's in Herb. Univ. Calif. as representing this species. He nevertheless maintained van Alderwerelt van Rosenburgh's species—though somewhat dubiously and with reservations—on the evidence of a Ceylon specimen of mine received shortly before the publication of his monograph. The specimen in question, however, is altogether different from van Alderwerelt van Rosenburgh's plant, as Alston's photograph of the type specimen clearly shows. My specimen (*Sledge 733*) is in fact typical *G. attenuata* but, as explained above under that species and *G. medialis*, it was referred to another species because Copeland, who had not seen Baker's original specimen of *Polypodium mediale,* had united this with *G. attenuata* and described specimens of it under the latter name.

Thwaites distributed *Grammitis reinwardtii* under the number *C.P. 3902*, the specimens in Herb. Kew, Herb. Brit. Mus., and Herb. Cambridge being labelled by him *Polypodium lasiosorum* Hook. One of the Kew sheets is localized as from " Bogawantalawa 5–6,000 ft." In Herb. Peradeniya one of the two sheets of

Thwaites C.P. 3902 named *P. hirtellum* is localized " On trees sparingly near Bogawantalawa, 5,000 ft., Mar. 1866 and Knuckles Hill, Sept. 1866 ". It was recollected on Knuckles Hill at 1,675 m. on 30 Jan. 1954 by Dr. T. G. Walker and myself. The only other Ceylon specimens or records for *G. reinwardtii* known to me are : forests of Dickoya and Telgama (Herb. Peradeniya) ; Morawaka, coll. Buxton Laurie *fide* Ferguson (Ceyl. Ferns : 47 (1880)) ; and Adam's Peak, coll. C. G. Matthew, one specimen in Herb. Kew.

XIPHOPTERIS Kaulf.

31. **Xiphopteris cornigera** (Bak.) Copel., Gen. Fil. : 215 (1947).

Polypodium cornigerum Bak. in Hook. & Bak., Synops. Fil., ed. 2 : 508 (1874).

A manuscript note in the Kew copy of Wall's *Catalogue of Ferns Indigenous to Ceylon* (on p. [10] of the Table) in the author's handwriting states that only a single specimen of this was found by Thwaites. The specimen (Horton Plains, 2,300 m., *Thwaites C.P. 4005*) is in the Peradeniya collection. No other gathering seems to have been made until it was refound by Prof. R. E. Holttum, Prof. I. Manton and myself growing epiphytically in dense jungle in a gorge near the Horton Plains Rest-house at 2,125 m. on 30 Dec. 1950.

CALYMMODON C. Presl

32. **Calymmodon cucullatus** (Nees & Bl.) C. Presl, Tent. Pterid. : 204 (1836).—Bedd., Ferns S. Ind. : 77, t. 233 (1864).

Polypodium cucullatum Nees & Bl. in Nov. Act. Phys. Med. Acad. Caes. Leop.-Carol. Nat. Cur. xi : 121 (1823).—Bedd., Handb. Ferns Brit. Ind. : 307 (1883).
Calymmodon glabrescens Copel. in Philipp. Journ. Sci. xxxiv : 263 (1927).

Copeland founded *Calymmodon glabrescens* on a single Ceylon gathering, *Beckett 265*, the type sheet being in Herb. Kew. I am unable to find any constant or significant difference in the paleae of Ceylon and Malaysian specimens. Ceylon plants vary less in habit than Malaysian ones but whilst it is true that the former show " no sign of the narrow form with tooth-like segments " and are " not so lax nor so elongate as the more ample form of *C. cucullatus* ", it is equally true that not all Malaysian plants are narrow and elongate. Some are indistinguishable in habit and other characters from Ceylon plants and as, moreover, Copeland refused to follow van Alderwerelt van Rosenburgh in recognizing habit differences as of any taxonomic significance in Malaysian *C. cucullatus*, he was scarcely justified in using them as an argument for separating the Ceylon plant. The fertile segments of the Ceylon plant were said to be " relatively shorter and more rounded " but there is again no constant difference ; indeed, some Malaysian gatherings (e.g. Gunong Hijan, Taiping, Perak, 5 Feb. 1908, *C. G. Matthew* in Herb. Kew) have orbicular fertile segments. The hairs on the margins of the fronds, whilst certainly more sparse than shown in Beddome's illustrations, are not very short as described by Copeland.

Calymmodon cucullatus is a frequent epiphyte in the wettest mountain forests of Ceylon and is one of a group of fern species, about 35 in number, common to Ceylon and the Malaysian region but absent from India.

CTENOPTERIS Bl.

33. **Ctenopteris glandulosa** J. Sm., Hist. Fil. : 185 (1875).

Polypodium glandulosum Hook., Sp. Fil. iv : 193 (1862) ; non *P. glandulosum* Desv. (1811).—Hook. & Bak., Synops. Fil. : 327 (1867).—Bedd., Ferns S. Ind. : 79, t. 238 B (1864).
Polypodium corticola C. Chr., Index Fil. : 188 (1905), 519 (1906) (" *corticolum* ").
Ctenopteris corticola (C. Chr.) Tagawa in Act. Phytotax. & Geobot. ix : 210 (1940).

Although *Polypodium glandulosum* Hook. non Desv. is an illegitimate name and Smith took up its epithet when transferring the species to *Ctenopteris*, his name is legitimate and must be adopted on grounds of priority.

The single sheet of *Thwaites C.P. 1289*, the type, in Herb. Peradeniya is labelled " Ramboda, Jan. 47 Gardner and 1863 Thw." The Kew sheet is unlocalized. Beddome (Handb. Ferns Brit. Ind. : 309 (1883)) refers to the occurrence of this species also on the summit of Wattakelia Hill, whence, however, I have seen no specimens. It does not appear to have been gathered again in either locality.

34. **Ctenopteris thwaitesii** (Bedd.) Sledge, comb. nov.[1]

Polypodium thwaitesii Bedd., Ferns Brit. Ind. : t. 188 (1866) ; Handb. Ferns Brit. Ind. : 309 (1883).—Hook. & Bak., Synops. Fil., ed. 2 : 508 (1874).

This endemic species was distributed by Thwaites as *C.P. 3900*, the sheet in Herb. Peradeniya being labelled " Forests above Dickoya, on trees ". Ferguson (Ceyl. Ferns : 48 (1880)) records it from the Nilambe forests above Le Vallon, Raxawa in Dolosbagie, and Rakwane, whence there are also specimens in Herb. Peradeniya. I have collected it only once on trees about the summit of Gallebodde Rock, 1,225 m., in the Central Province. The rather thick, scaly, wide-creeping rhizome and glabrous fronds separate this from all other Ceylon species of *Ctenopteris*.

35. **Ctenopteris moultonii** (Copel.) C. Chr. & Tard. in Notul. Syst. viii : 181 (1939). —Holtt., Fl. Malaya ii : 229 (1954).

Polypodium decorum sensu Bedd., Ferns S. Ind. : 78, t. 238 A (1864) ; Handb. Ferns Brit. Ind. : 310 (1883) ; non Brackenr.
Polypodium moultonii Copel. in Philipp. Journ. Sci., Sect. C, x : 149 (1915) (" *Moultoni* ").—C. Chr. & Holtt. in Gard. Bull. Straits Settl. vii : 300 (1934).

Confined, in Ceylon, to the southern part of the island, especially the Sinha Raja Forest where it is not infrequent. Holttum (loc. cit.) omits Ceylon from its distribution, though accepting Beddome's figured plant (from Ceylon) as this species.

---

[1] Abeywickrama in Ceyl. Journ. Sci., Sect. A, xiii : 29 (1956), used this combination but did not give it valid publication by reference to its basionym.

36. **Ctenopteris repandula** (Mett.) C. Chr. & Tard. in Lecomte, Flor. Génér. Indo-Chine vii, 2 : 533 (1941).

Polypodium repandulum Mett. in Abhandl. Senckenb. Naturforsch. Ges. ii : 50 (1856).—Bedd., Handb. Ferns Brit. Ind. : 313 (1883).

The name *Ctenopteris repandula* is usually said to have been published by Kunze in Zollinger, Syst. Verz. : 37 (1854), but I can find no trace of it in that work. The species was first described by Mettenius and the above seems to be the first valid publication of the combination under *Ctenopteris*.

Thwaites C.P. 1290 is this species. This and the next species have been much confused and the *C. P.* numbers quoted by Beddome (op. cit. : 313, 314) should be transposed. The subcoriaceous texture of the fronds and their repand segments, which are more widely spaced, serve to distinguish it readily from *Ctenopteris subfalcata*, in which the fronds are soft in texture, more hairy, and with more closely placed, toothed segments.

37. **Ctenopteris subfalcata** (Bl.) Kunze in Bot. Zeit. vi : 120 (1848).

Polypodium subfalcatum Bl., Enum. Pl. Jav. ii : 130 (1828).—Bedd., Handb. Ferns Brit. Ind. : 314 (1883).
Polypodium subminutum Alderw. van Rosenb., Malayan Ferns : 598 (1908).
Ctenopteris subminuta (Alderw. van Rosenb.) Holtt., Fl. Malaya ii : 228 (1954).

Thwaites C.P. 3073 is this species. It varies in the development of the pubescence and the degree of serration. Usually the fronds are sparingly clothed with rather long hairs but some specimens have sparser and shorter hairs. I am unable to detect any correlated differences. Holttum (in Gard. Bull. Straits Settl. vii : 302 (1934)) recorded *Polypodium subminutum* Alderw. van Rosenb. from Ceylon but its occurrence there is queried in his *Ferns of Malaya*. This is doubtfully distinct from *Ctenopteris subfalcata* and Holttum comments (in litt.) on a series of my Ceylon specimens submitted to him that they " seem to unite the species *subfalcata* and *subminuta* ". Malayan specimens sent by him as *C. subminuta* have been found by Prof. I. Manton to agree cytologically with Ceylon *C. subfalcata*.

PROSAPTIA C. Presl

38. **Prosaptia obliquata** (Bl.) Mett. in Reise Österr. Fregatte Novara, Bot. i : 214 (1870).—C. Chr. & Tard. in Notul. Syst. viii : 180 (1939).

Polypodium obliquatum Bl., Enum. Pl. Jav. ii : 128 (1828).—Bedd., Handb. Ferns Brit. Ind. : 311 (1883).
Ctenopteris obliquata (Bl.) Tagawa in Act. Phytotax. & Geobot. xv : 187 (1954).—Holtt., Fl. Malaya ii : 229 (1954).

Holttum (tom. cit. : 224) unites *Prosaptia* with *Ctenopteris*. Alston (in Bol. Soc. Brot., Sér. 2, xxx : 26 (1956)) unites *Ctenopteris* with *Xiphopteris*. Copeland (Gen. Fil. : 219 (1947)) has pointed out that the affinity of *Ctenopteris* and *Grammitis* is also " so intimate that there is no objection in principle to Ching's recent action in combining them". It seems best, therefore, to retain *Xiphopteris*, *Ctenopteris* and *Prosaptia* until a critical re-examination of the whole group has been made. As represented in Ceylon they are very distinct. The species here referred to *Prosaptia* differ not only in their deeply sunken sori, which may be marginal or superficial in position, but also in their strongly ciliate rhizome scales.

39. **Prosaptia khasyana** (Hook.) C. Chr. & Tard. in Notul. Syst. viii : 180 (1939) ; in Lecomte, Fl. Génér. Indo-Chine vii, 2 : 531 (1941).

Polypodium khasyanum Hook., Ic. Pl. x : t. 949 (1854).—Bedd., Ferns Brit. Ind. : t. 173 (1866) ; Handb. Ferns Brit. Ind. : 308 (1883).—Hook. & Bak., Synops. Fil. : 325 (1867).
Ctenopteris khasyana (Hook.) Holtt., Fl. Malaya ii : 233 (1954).

New to Ceylon. I collected a single specimen in the Sinha Raja Forest above the Beverley Estates, Deniyaya, at c. 875 m., on 4 Apr. 1954. Elsewhere known from Assam, Burma, Hainan, Annam, Cambodia, Malaya (Perak and Pahang), Borneo and Celebes.

40. **Prosaptia contigua** (Forst. f.) C. Presl, Tent. Pterid. : 166 (1836).—Bedd., Ferns S. Ind. : 6, t. 19 (1863) ; Handb. Ferns Brit. Ind. : 56 (1883).

Trichomanes contiguum Forst. f., Florul. Ins. Austr. Prodr. : 84 (1786).
Davallia contigua (Forst. f.) Sw., Synops. Fil. : 130 (1806).
Polypodium contiguum (Forst. f.) J. Sm. in Hook., Journ. Bot. iii : 394 (1841).
Ctenopteris contigua (Forst. f.) Holtt., Fl. Malaya ii : 230 (1954).

Common on rocks and trees in forests above 1,500 m.

41. **Prosaptia alata** (Bl.) Christ in Ann. Jard. Bot. Buitenz. xx : 127 (1905).

Davallia alata Bl., Enum. Pl. Jav. ii : 230 (1828).
Davallia emersonii Hook. & Grev., Ic. Fil. : t. 105 (1829) ("*Emersoni*").
Prosaptia emersonii (Hook. & Grev.) C. Presl, Tent. Pterid. : 166 (1836).
Ctenopteris alata (Bl.) Holtt., Fl. Malaya ii : 232 (1954).

Less common than the preceding, and at lower elevations.

SCLEROGLOSSUM Alderw. van Rosenb.

42. **Scleroglossum sulcatum** (Kuhn) Alderw. van Rosenb. in Bull. Jard. Bot. Buitenz., Sér. 2, vii : 39 (1912).—C. Chr. in Dansk Bot. Ark. vi, 3 : 28, t. 2 fig. 5 (1929).

Taeniopsis falcata Bedd., Ferns Brit. Ind. : t. 175 (1866) pro parte ; non *Vittaria falcata* Fée.
Vittaria sulcata Kuhn in Linnaea xxxvi : 68 (1869).—Bedd., Handb. Ferns Brit. Ind. : 408 (1883).
Taeniopsis sulcata (Kuhn) Bedd., Suppl. Ferns S. Ind. & Brit. Ind. : 25 (1876).

The type is *Thwaites C.P. 3807* from Ceylon. This is closely related to *Scleroglossum pusillum* (Bl.) Alderw. van Rosenb., with which it is combined by Copeland

(Gen. Fil. : 213 (1947)). Christensen (loc. cit.) after study of the type number and a few other gatherings in Herb. Kew and Herb. Brit. Mus. maintained it as distinct, though with some doubt. It is a rare fern in Ceylon about which too little is known to allow certain decision as to its status. I know it only from herbarium specimens and prefer to follow Christensen until more information is available.

BRITISH MUSEUM
- 1 MAR 1960
NATURAL HISTORY

PRINTED IN GREAT BRITAIN BY
ADLARD AND SON, LIMITED
BARTHOLOMEW PRESS, DORKING

A.
0.

ALLIUM AND *MILULA* IN THE CENTRAL AND EASTERN HIMALAYA

WILLIAM T. STEARN

BRITISH MUSEUM
31 MAY 1960
NATURAL HISTORY

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 6
LONDON: 1960

ALLIUM AND *MILULA* IN THE CENTRAL AND EASTERN HIMALAYA

BRITISH MUSEUM
31 MAY 1960
NATURAL HISTORY

BY

WILLIAM T. STEARN

x ref.

Pp. 159–191 ; 10 *Text-figures* ; *Plates* 9–12

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 6
LONDON: 1960

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 6 of the Botany series.

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued May 1960 *Price Sixteen shillings*

ALLIUM AND *MILULA* IN THE CENTRAL AND EASTERN HIMALAYA

By WILLIAM T. STEARN

THE account of the genus *Allium* in Sir Joseph Hooker's *Flora of British India* (1892) is primarily concerned with the species of the Punjab Himalaya, the Kumaun Himalaya and Sikkim. Little or no herbarium material was available to Hooker from the Nepal Himalaya, the Assam Himalaya and the adjacent region of south-eastern Tibet. Political and topographical difficulties had kept them closed to detailed botanical survey, whereas many collections had been made in Kashmir and the Himalaya west of the Nepal frontier. British expeditions to Bhutan and south-eastern Tibet between 1933 and 1949 and to Nepal between 1949 and 1956, together with expeditions by F. Kingdon-Ward to the Assam Himalaya and adjacent Tibet between 1924 and 1935, have now provided abundant material for monographic studies of Himalayan plants. The following paper accordingly gives a key to the species of *Allium* now known for the area extending eastward from the western frontier of Nepal to the region of the Tsangpo Gorges (to about 96° E.), including Sikkim ; it also lists the specimens of this genus and of the closely related *Milula* which are available in the herbaria of the British Museum (Natural History) and the Royal Botanic Gardens, Kew. The distribution of these species has considerable bearing upon the plant-geography of the Himalaya, notably upon its division into botanical provinces, and this is discussed below. Three new Himalayan species and one from Burma are described ; nine hitherto accepted names are reduced to synonymy. Notes on related Chinese species are included.

In 1904, some fifty-three years after his return from India and seven years after the completion of the *Flora of British India* (1875–97), Hooker published a *Sketch of the Flora of British India*. Therein he outlined the phytogeographical conclusions to which his many years of studying Indian plants had led him. The term " British India " then covered " over and above the vast territory controlled by the Government of India, some wholly independent countries, of which Nepāl, and the Himālaya east of Sikkim are the chief ; together with Ceylon and the Malayan Peninsula ", as stated by Hooker. He divided his Himalayan botanical region into two botanical provinces, the Western and the Eastern. The Western Himalaya he defined as extending from Kumaun west to Chitral, and the Eastern Himalaya as extending from Sikkim east to the Mishmi Hills in Upper Assam. Unfortunately, owing to ignorance of its flora, Hooker had to leave out of account the closed and independent kingdom of Nepal stretching for some 500 miles between the Eastern and the Western Himalaya. He had, moreover, to deduce the general character of the Eastern Himalayan flora from the only part then botanically well known, i.e.

Sikkim and a little of adjacent eastern Nepal, which he himself had visited in 1848 and 1849. Not enough collecting had been done in Bhutan and western China to emphasize their close floristic resemblance; no-one then knew how far west into Nepal characteristic Sino-Himalayan species ranged. In 1940, although with little more information to hand about the flora of Nepal than Hooker had possessed in 1904, Chatterjee formally distinguished it as the Central Himalaya botanical province. This can, however, be accepted only as a convenient political concept unsupported by present phytogeographical evidence.

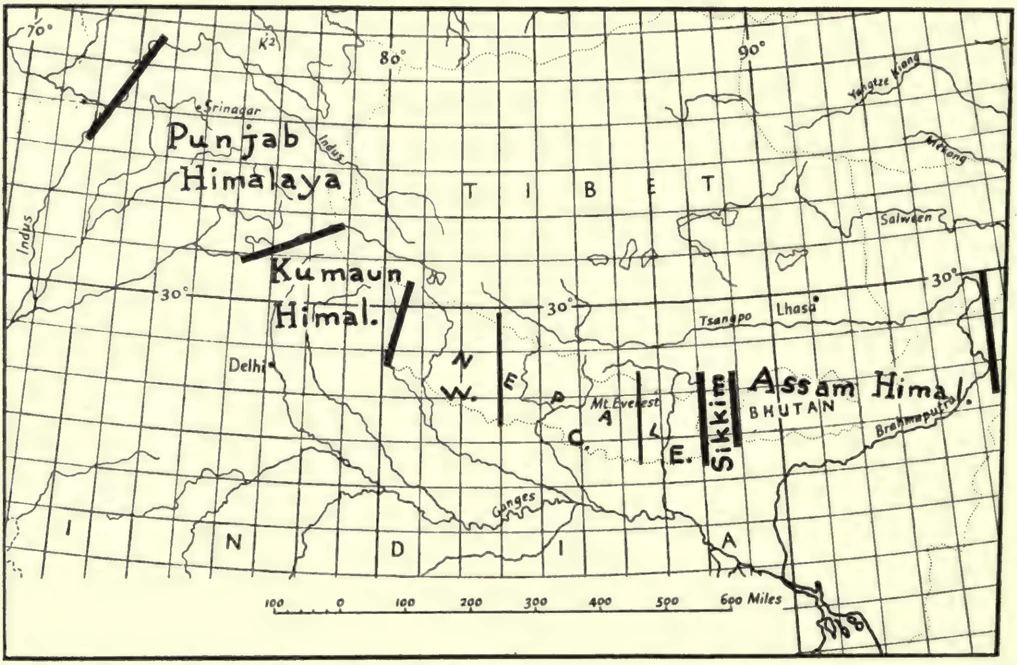

70°
K²
80°
90°
Srinagar
Punjab Himalaya
Indus
Yangtze Kiang
Mekong
T I B E T
Salween
Indus
Kumaun Himal.
30°
30°
30°
Tsangpo
Lhasa
Delhi
N W.
N E P A L
C.
E.
Mt. Everest
Sikkim
Assam Himal.
BHUTAN
Brahmaputra
Ganges
I N D I A
100 0 100 200 300 400 500 600 Miles

FIG. 1. Divisions of the Himalaya (adapted from K. Mason, 1955).

Study of the genus *Allium* confirms the impression given by other genera that the flora of Bhutan is closely linked to and partly conspecific with the flora of western China and that Nepal is a meeting place of the Eastern and Western Himalayan floras as regards the high-mountain humid areas, and an extension of Tibet as regards its high-mountain arid zone, rather than a floristic province in its own right. Further collecting north of the main Himalayan range will probably reveal the presence there of species at present only known from Central Asia.

Although some Alliums are woodland plants, notably *A. ursinum* L., *A. tricoccum* Ait. and members of the complex including *A. victorialis* L., most of them inhabit open places, such as rocky slopes, steppes and alpine meadows, favourable to wide distribution. Thus in the Himalaya they occur in the regions of alpine steppe and of moist alpine scrub and meadows (cf. Schweinfurth, 1957) at altitudes roughly

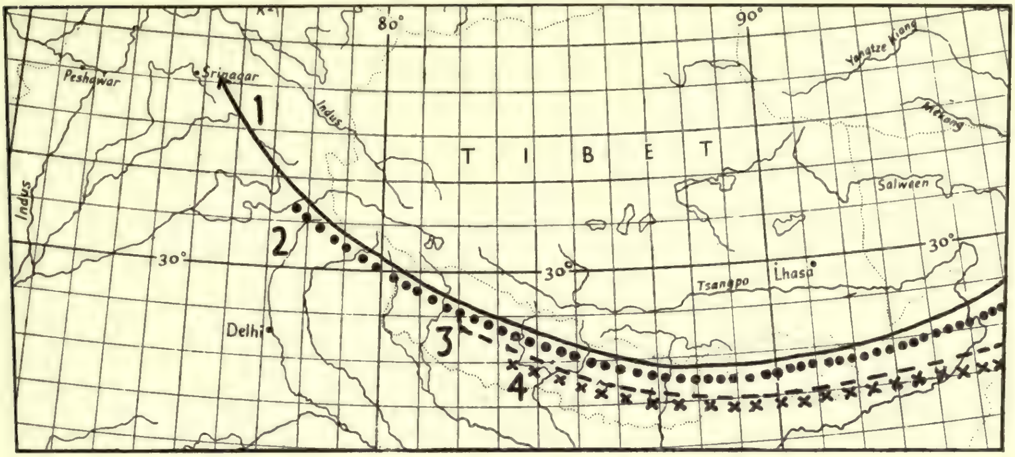

K2
80°
90°
Peshawar
Srinagar
1
Indus
Yangtze Kiang
Mekong
T I B E T
Indus
Salween
2
30°
30°
30°
Tsangpo
Lhasa
Delhi
3
4

FIG. 2. Ranges in the Himalaya of some Sino-Himalayan species: 1 ——— *Aletris pauciflora*; 2 .... *Cardiocrinum giganteum*; 3 — — — *Primula sikkimensis*; 4 × × × × *Magnolia campbellii.*

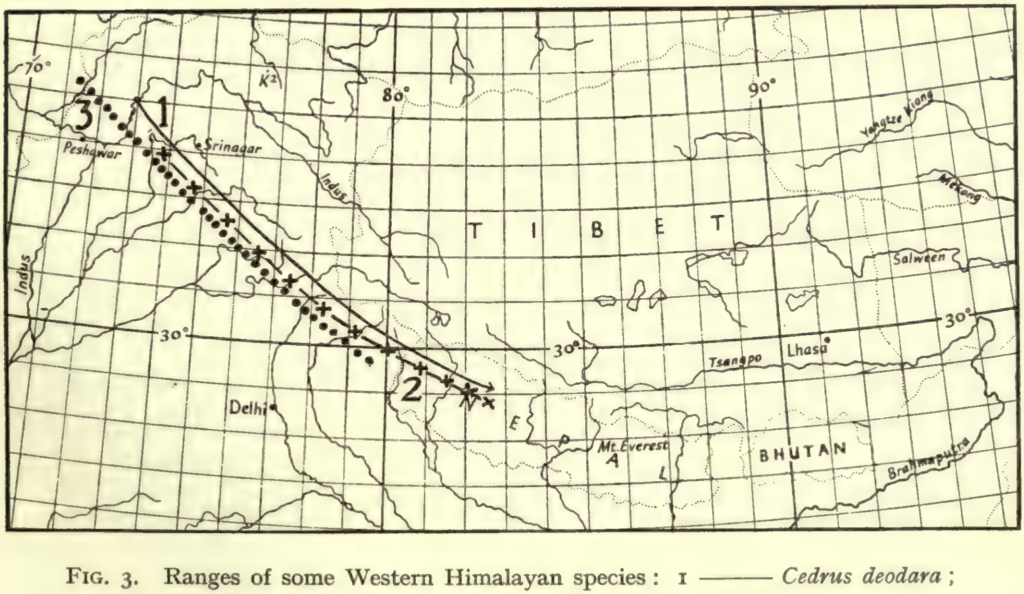

70°
K2
80°
90°
3
1
Peshawar
Srinagar
Indus
Yangtze Kiang
Mekong
T I B E T
Indus
Salween
30°
30°
30°
Tsangpo
Lhasa
Delhi
2
N E P A L
Mt. Everest
BHUTAN
Brahmaputra

FIG. 3. Ranges of some Western Himalayan species: 1 ——— *Cedrus deodara*; 2 ×—×—× *Allium stracheyi*; 3 .... *Lilium polyphyllum.*

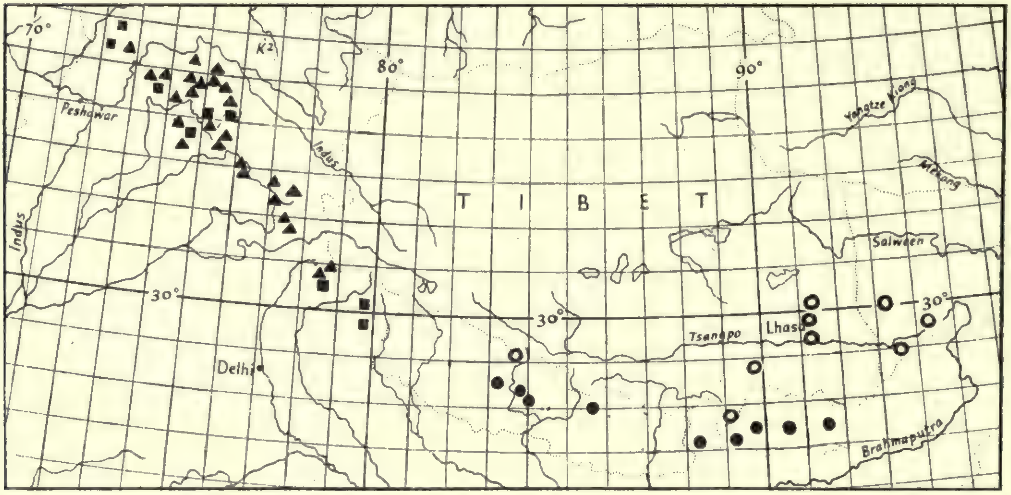

70°
K²
80°
90°
Peshawar
Yangtze Kiang
Mekong
Indus
Indus
T I B E T
Salween
30°
30°
30°
Tsangpo
Lhasa
Delhi
Brahmaputra

FIG. 4. Distribution of : ■ *Paeonia emodi* ; ▲ *Primula rosea* (after Wendelbo, 1957) ; ○ *Milula spicata* ; ● *Magnolia campbellii* (in the Himalayan range).

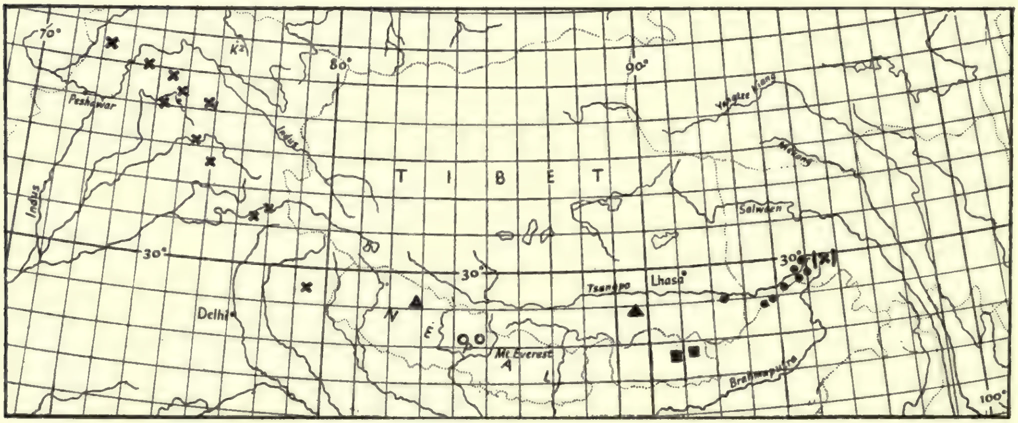

70°
K²
80°
90°
Peshawar
Yangtze Kiang
Mekong
Indus
Indus
T I B E T
Salween
30°
30°
30°
Tsangpo
Lhasa
Delhi
N E P A L
Mt Everest
Brahmaputra
100°

FIG. 5. Distribution of : × *Lilium polyphyllum* ; ▲ *Ceratostigma ulicinum* ; ○ *Meconopsis regia* ; ■ *Lilium sherriffiae* ; ● *Primula florindae* ; |×| *Lilium paradoxum.*

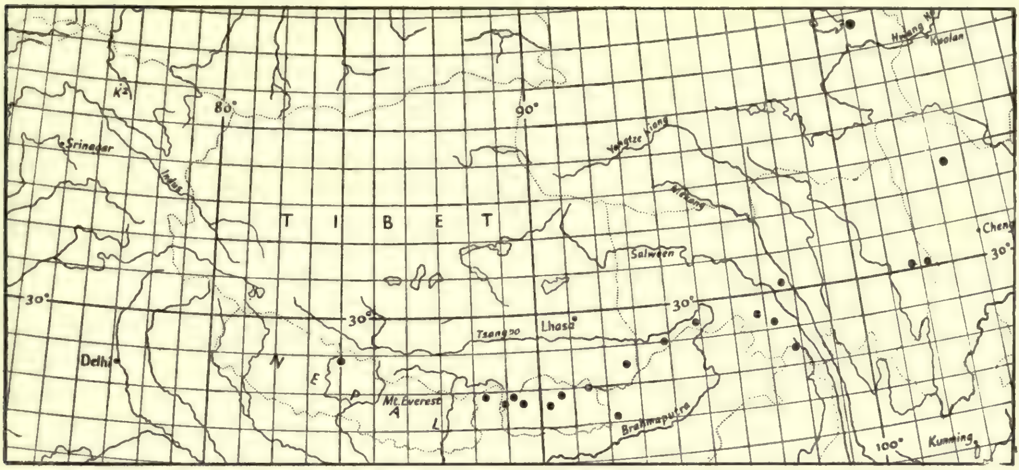

K²
80°
90°
Srinagar
Indus
T I B E T
Yangtze Kiang
Hwang Ho
Kuolan
Mekong
Salween
Cheng
30°
30°
30°
30°
Lhasa
Tsangpo
Delhi
N E P A L
Mt. Everest
Brahmaputra
100°
Kunming

FIG. 6. Distribution of *Allium sikkimense*.

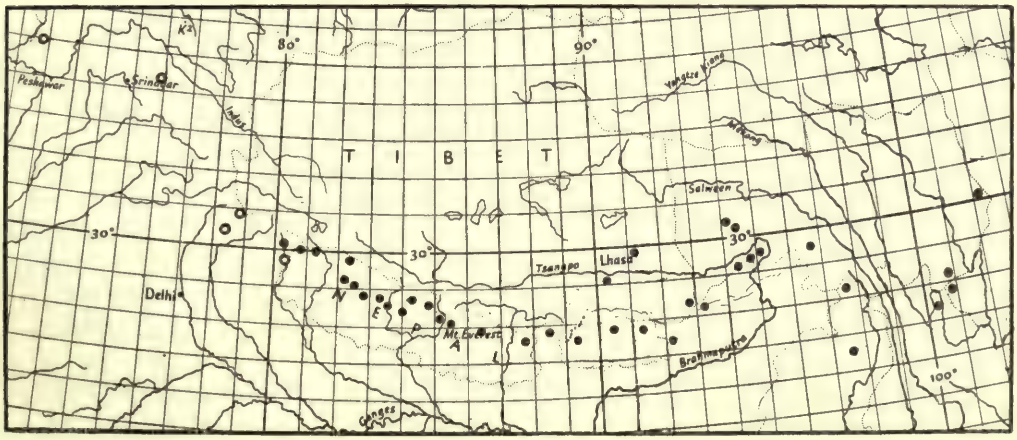

K²
80°
90°
Peshawar
Srinagar
Indus
T I B E T
Yangtze Kiang
Mekong
Salween
30°
30°
30°
Lhasa
Tsangpo
Delhi
N E P A L
Mt. Everest
Brahmaputra
Ganges
100°

FIG. 7. Distribution of : ○ *Allium victorialis* (in the Himalaya) ; ● *A. prattii*.

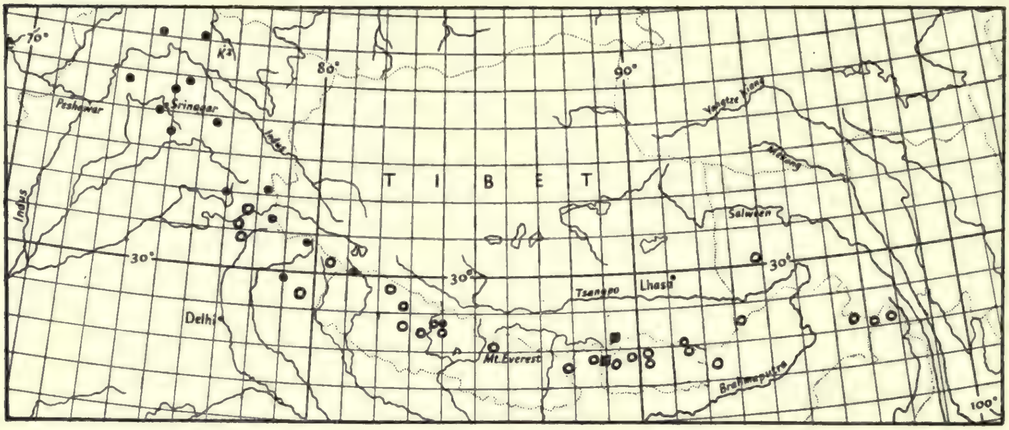

70°
K2
Peshawar
Srinagar
Indus
Indus
80°
90°
Yangtze Kiang
Mekong
T I B E T
Salween
30°
30°
30°
Tsangpo
Lhasa
Delhi
Mt. Everest
Brahmaputra
100°

FIG. 8. Distribution of : ● *Allium carolinianum* (*in the Himalaya*) ; ○ *A. wallichii* ; ■ *A. phariense.*

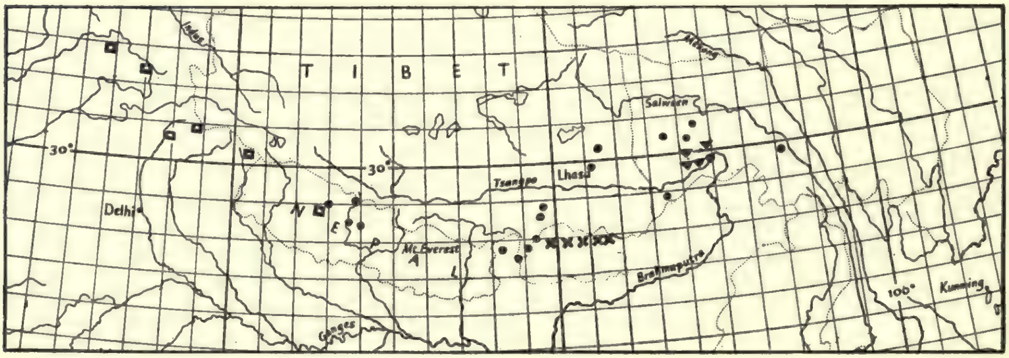

Indus
Mekong
T I B E T
Salween
30°
30°
Tsangpo
Lhasa
Delhi
N E P A L
Mt. Everest
Brahmaputra
100°
Kunming
Ganges

FIG. 9. Distribution of : □ *Allium stracheyi* ; ● *A. fasciculatum* ; × *A. rhabdotum* ; ▼ *A. kingdonii.*

between 2,000 m. (6,500 ft.) and 5,200 m. (17,500 ft.). They differ in their ecological preferences even when occurring within the same general area. *A. prattii*, for example, grows usually in moist situations among bushes. *A. sikkimense*, on the other hand, evidently prefers more open situations, on steep slopes and at times on cliffs. It is apparent that the *Allium* species of Eastern Asia possess wider ranges and greater variability than have hitherto been attributed to them. Thus *A. sikkimense* of upper Sikkim is evidently conspecific with *A. tibeticum* of adjacent Tibet and this with *A. kansuense* of Kansu, which links on to Shensi in northern central China, where similar material has been collected. *A. macranthum*, likewise first described from upper Sikkim, occurs here and there in southern Tibet, Yunnan and Shensi. *A. hookeri*, although its type locality is in Ceylon, has its main range in Assam (Khasi Hills), southern Tibet, Yunnan and Szechwan. *A. prattii* and *A. wallichii* both extend westward along the Himalaya from western China to beyond Nepal. These are species of the Eastern Himalaya, but ranges of considerable extent characterize such Western Himalayan species as *A. carolinianum* and *A. stracheyi*. The patterns of distribution presented by these species are paralleled in other northern genera inhabiting the Himalayan region, a few examples being given below. Provisionally we may distinguish ten types of range of montane and alpine Himalayan species :

(1) Species of Western, Central and Northern Asia : (*a*) extending into Kashmir, e.g. *Allium rubellum*, *A. schoenoprasum*, *Anemone biflora* ; (*b*) extending along the Western Himalaya, e.g. *Allium victorialis* (fig. 7), *A. carolinianum* (fig. 8).

(2) Species confined to the Western Himalaya (including western Nepal) and possibly adjacent Afghanistan, e.g. *A. stracheyi* (figs. 3, 9), as well as *Lilium polyphyllum* (figs. 3, 5), *L. oxypetalum*, *Notholirion thomsonianum*, *Paeonia emodi* (fig. 4), *Primula floribunda*, *P. rosea* (fig. 4), *Cedrus deodara* (fig. 3).

(3) Species confined to Nepal on southern slopes of the main Himalayan mountain-range, e.g. *Meconopsis regia* (fig. 5), *Primula sharmae*, *P. wigramiana* ; no Allium is known to have this range.

(4) Species of western China extending along the whole Himalaya to or into Kashmir, e.g. *Aletris pauciflora* (fig. 2), *Anemone rupicola*, *A. vitifolia* ; no Allium is known to have this range.

(5) Species of western China extending from Yunnan along the Eastern Himalaya over much of Nepal and in some instances beyond it into the Kumaun Himalaya, e.g. *Allium prattii* (fig. 7), *A. wallichii* (fig. 8), as well as *Cardiocrinum giganteum* (fig. 2), *Notholirion macrophyllum*, *Magnolia campbellii* (figs. 2, 4), *Primula sikkimensis* (fig. 2).

(6) Species confined to the Eastern Himalaya, e.g. *Allium rhabdotum* (fig. 9), *A. phariense* (fig. 8), *Lilium sherriffiae* (fig. 5).

(7) Species extending from north-western China (Kansu) over Tibet to the Himalaya, e.g. *Allium atrosanguineum*, *A. chrysanthum*, *A. przewalskianum*, *A. sikkimense* (fig. 6).

(8) Species of the dry plateau zone of Tibet, some reaching the dry zone of Sikkim or Nepal or both, e.g. *Allium fasciculatum* (fig. 9) as well as *Milula spicata* (fig. 4), *Ceratostigma ulicinum* (fig. 5).

(9) Species confined to the moist river-gorge country of south-eastern Tibet, e.g. *Allium kingdonii* (fig. 9), as well as *Lilium paradoxum* (fig. 5), *Primula florindae* (fig. 5).

(10) Species occurring in the Himalaya and Ceylon or Southern India or both, e.g. *Allium hookeri*, *Anemone rivularis*.

The general impression given by these distributional patterns is of the Himalaya as primarily a route of emigration and colonization from the east and north-west, secondarily of endemic development, with species of the Western and Central Asian mountain groups suited to comparatively dry conditions extending along the upper region of the Himalaya from Afghanistan to western Nepal and with species of western China suited to moister conditions extending westward to western Nepal and adjacent Kumaun. In the area between 80° and 84° E. climatic factors presumably limit the capacity of plants suited to the one province to compete with those of the other and hence here is an area of interpenetration and limitation. The earlier view of very high local endemism reflected inadequate collecting. Geologically the Himalaya is younger than the Chinese mountains eastward, whence much of its montane and alpine flora must have come and where descendants of the original stocks, notably in the groups of *Allium* typified by *A. victorialis* and *A. wallichii*, maintain a greater polymorphism than their Himalayan representatives. Work on Himalayan species thus points continually to the need for study at the same time of their Chinese relatives. During the pioneer stage of East Asiatic floristic botany in the 19th and early 20th centuries it happened often that the Chinese and Himalayan populations of the same species were given different names as much of the work on the Chinese flora was done at Paris and Leningrad and much of that on the Indian flora at Kew. It is now inevitable that correlation should cause many previously accepted names to fall into synonymy. In the following account I have put together material which seems to me conspecific without attempting formally to distinguish local variants such as may well be recognized, for example, within *A. mairei* (sensu lato) and *A. atrosanguineum* (sensu lato).

Burrard and Hayden (1907, part 2 : 76–79) and Kenneth Mason (1955) have partitioned the Himalaya into divisions convenient for general purposes (fig. 1). From west to east these are the Punjab Himalaya (between the Indus and the Sutlej) and the Kumaun Himalaya (extending east of the Sutlej to the Kali which forms the western border of Nepal), the Nepal Himalaya (with three subdivisions), the Sikkim Himalaya and the Assam Himalaya (mostly in Bhutan and the territory between Bhutan and the Brahmaputra). Beyond the Punjab Himalaya lies Trans-Himalaya (principally the Karakoram and its associate ranges). For botanical purposes the Nepal Himalaya may be divided into three subdivisions, approximating to Mason's though not identical : Western Nepal (from the Kumaun frontier to 83° E. and thus corresponding roughly to Mason's Karnali section), Central Nepal (83° E. to 86° 30′ E., corresponding roughly to Mason's Gandaki section, which extends from Dhaulagiri to Katmandu, i.e. 82° 59′ to 85° 12′ E.) and Eastern Nepal (86° 30′ E. to the Sikkim frontier and thus corresponding roughly to Mason's Kosi section). Because of Nepal's importance as an area of transition, these subdivisions are used in the following enumeration.

Since, as indicated above, the ranges of eastern species vary so greatly in their westward extension and may even spread from Yunnan to Kashmir, whereas western species going eastward beyond Kashmir have no comparably wide eastward extension and stop in western Nepal if not in Kumaun, it is convenient to define the Western Himalaya botanical province by the ranges of species related closely to species of Western and Central Asia. Any line of demarcation must necessarily be arbitrary : it cannot but be crudely drawn in an area of such complexity and is indeed likely to be different for different genera. For the genus *Allium*, at least, the main region of transition lies between 80° E. and 84° E. On general grounds *longitude* 83° *E. may be taken as the boundary between the Western and the Eastern Himalaya as botanical provinces.* It may be noted that *Cedrus deodara*, which has related species in Western Asia and North Africa, reaches its eastermost known station at 82° 50′ E., while *Magnolia campbellii* on the other hand reaches its westernmost known station at 83° 15′ E.

The maps are based on specimens in the herbaria of the British Museum (Natural History) and the Royal Botanic Gardens, Kew. My own Himalayan experience being confined to Sikkim and the Mussoorie region, I have been much helped in the preparation of the maps by Mr. Frank Ludlow and Mr. L. H. J. Williams ; the one has ungrudgingly made available his extensive first-hand knowledge of Kashmir, Kumaun, Bhutan and Tibet, the other his similar knowledge of Nepal. I have also profited much from the constructive criticism of Mr. J. E. Dandy, who has studied for many years the monocotyledons of the Himalayan region. Unless indicated as belonging to Kew, the specimens cited all belong to the British Museum (Natural History).

KEY TO THE SPECIES OF *ALLIUM* AND *MILULA* IN THE CENTRAL AND EASTERN HIMALAYA

Inflorescence spiciform ; tepals connate below . . . . *Milula spicata*
Inflorescence umbellate ; tepals free to the base . . . . *Allium* :
  Perianth ovoid-campanulate, c. 10 mm. long, the tepals truncate ; ovary with 6 well-marked apical swellings ; umbel loose with pendulous flowers ; filaments equalling or slightly longer than the tepals ; stamens and style exserted 15. *macranthum*
  Perianth otherwise, the tepals obtuse or acute ; ovary without well-marked apical swellings :
    Stamens concealed within and shorter than the funnel-shaped or campanulate perianth :
      Stem stout (c. 5 mm. thick) ; leaves fistulose ; filaments connate for ½ of their length into a short cup . . . . . . 14. *atrosanguineum*
      Stem slender (0·5–2 mm. thick) ; leaves not fistulose ; filaments free almost to the base :
        Pedicels much longer than the perianth, 1·5–3·5 cm. long ; tepals separating shortly above the base ; leaves filiform or very narrowly linear (1·5 mm. or less broad) . . . . 8. *mairei*

Pedicels equalling or shorter than the perianth, not more than 1·5 cm. long ; tepals overlapping for most of their length ; leaves broader (2–20 mm. broad) :

Perianth pale blue or purplish-blue, 5–9 mm. long ; filaments of the inner stamens markedly broadened and shouldered at the base 9. *sikkimense*

Perianth reddish (pink to purple) ; filaments gradually broadened at the base :

Bulb-coat breaking into longitudinal strips ; umbel loose, 1–5-flowered ; perianth 14–18 mm. long . . . . 7. *kingdonii*

Bulb-coat reticulately fibrous ; umbel dense, 12–40-flowered ; perianth 7–10 mm. long . . . . . . 17. *hypsistum*

Stamens easily visible, the perianth stellate with spreading or reflexing tepals not covering the anthers and upper parts of the filaments, or the perianth campanulate with ascending or erect tepals shorter than the stamens :

Tepals reflexing or spreading at anthesis, the ovary exposed ; filaments slightly shorter than the tepals :

Perianth normally purple ; leaves broad (8–20 mm.), keeled 11. *wallichii*

Perianth always white ; leaves narrower (1–8 mm. broad) :

Tepals narrowly ovate ; bulb covered with interwoven fibres 10. *tuberosum*

Tepals lanceolate or linear ; bulb with short parallel fibres at the base :

Roots slender ; dehisced anthers about 1–1·8 mm. long 12. *hookeri*

Roots tuberous ; dehisced anthers about 0·6 mm. long 13. *fasciculatum*

Tepals erect or ascending, the ovary concealed ; filaments longer than the tepals :

Leaves fistulose, their bases sheathing the stem for $\frac{1}{3}$–$\frac{1}{2}$ its length ; stem tall (80–125 cm. high) . . . . . . 16. *rhabdotum*

Leaves flat, narrowly elliptic to subulate or filiform, more or less basal or sheathing the stem for not more than $\frac{1}{4}$ its length ; stem shorter (9–45 cm. high) :

Leaves 2 (very rarely 3), distinctly contracted at the base, usually very narrowly elliptic and usually more than 15 mm. broad (varying from 5 to 60 mm.) ; bulb-coat of reticulate dull brown fibres ; flowers reddish, in a loose umbel, the pedicels visible . . 1. *prattii*

Leaves 3–12, or if 2 then plant not with above characters :

Inner filaments expanded below the middle into a broad oblong base toothed on each side at the top ; outer filaments subulate ; bulb-coat with finely reticulate red-brown fibres ; flowers mauve to lilac or purplish . . . . . 2. *przewalskianum*

Filaments all simple, subulate ; bulb-coat membranous, coriaceous or with parallel fibres, not reticulate :

Stem 7–9 cm. high from the top of the bulb ; leaves 3–8 cm. long, 1–3 mm. broad, spreading ; flowers "white" or pink with deeper-red mid-nerve . . . . 6. *phariens*

Stem 15–55 cm. high from the top of the bulb ; leaves more than 9 cm. long, ascending or erect :
  Tepals yellow or yellowish-white without trace of red . . . 5. *chrysanthum*
  Tepals purple, pink or reddish with a deeper-red mid-nerve :
    Leaves not more than 3 mm. broad ; bulb-coat with long more or less parallel fibres ; ovary with large hooded nectarial pits . . . . 4. *stracheyi*
    Leaves 4–11 mm. broad ; bulb-coat with rather coriaceous scales ; ovary without conspicuous pits 3. *carolinianum*

ALLIUM L.

1. **Allium prattii** C. H. Wright apud Forbes & Hemsl. in Journ. Linn. Soc. Lond., Bot. xxxvi : 124 (1903).—Stearn in Herbertia xii : 79 (1947).

Allium ellipticum Wall., Numer. List : 177, n. 5069 (1832), *nom. nud.*

Allium victorialis sensu Bak. in Journ. of Bot. xii : 291 (1874) pro parte ; non L.—Regel, Allior. Monogr. : 170 (1875) pro parte.—Hook. f., Fl. Brit. Ind. vi : 342 (1892) pro parte.—Sm. & Cave in Rec. Bot. Surv. Ind. iv : 247 (1911).—Kitamura in Kihara, Fauna & Fl. Nepal Himal. i : 91 (1955).

Allium victorialis var. *angustifolium* Hook. f., tom. cit. : 343 (1892).

Allium prattii var. *ellipticum* Wang & Tang in Bull. Fan Mem. Inst. Biol., Bot. Ser. vii : 297 (1937).

WESTERN NEPAL : Saipal, 4,500 m., 20 Aug. 1954, *Arnold 140.* Nampa Gadh, 3,600–3,900 m., 26 July 1886, *Duthie 6045* (Herb. Kew). South of Jumla, 3,450 m., 2 July 1952, *Polunin, Sykes & Williams 4420.* Khaptang, Mugu Khola, 4,500 m., 21 Aug. 1952, *Polunin, Sykes & Williams 5375.* Near Tarakot, Bheri River, 3,150 m., 9 July 1952, *Polunin, Sykes & Williams 2413.* Near Balangra Pass, 3,750 m,. 22 July 1952, *Polunin, Sykes & Williams 2540.*

CENTRAL NEPAL : Near Phagune Dhuri, 3,600 m., 7 July 1954, *Stainton, Sykes & Williams 3414.* Lete, Kali Gandaki Valley, 3,150 m., 4 June 1954, *Stainton, Sykes & Williams 5605* ; 3,000 m., 6 June 1954, *Stainton, Sykes & Williams 983.* Seti Khola, Annapurna Himal, 4,050 m., 30 July 1954, *Stainton, Sykes & Williams 6553.* Marsiandi Valley, 3,900 m., 11 July 1950, *Lowndes 1171.* Teenlakh, 3,750 m., 30 Apr. 1932, *Sharma E293.* Larkya Bazar, 4,050 m., 5 July 1953, *Gardner 1138.* En route Tanget, 2,700 m., 26–28 July 1949, *Polunin 1462.* Lakarivinayak, 3,560 m., 3 June 1957, *Fell 37.* Gossain Than, *Wallich 5069* (holotype of var. *ellipticum* in Herb. Kew).

EASTERN NEPAL : Arun-Tamur watershed, south of Topke Gola, 3,900 m., 8 July 1956, *Stainton 880.*

SIKKIM : Tangu, 4,200 m., 15 Aug. 1909, *Smith & Cave 2450.* Lachen, 3,600 m., 16 July 1849, *Hooker* (lectotype of *A. victorialis* var. *angustifolium* in Herb. Kew). Tallum Sandong, 30 July 1849, *Hooker* (Herb. Kew).

BHUTAN : Parshong Timpu, 3,600 m., 27 Nov. 1914, *Cooper 1969.* Ju La, Mangde Chu, 4,200–4,500 m., 19 July 1949, *Ludlow, Sherriff & Hicks 16902, 16904.* Ju La, Dhur Chu, 3,900 m., 21 July 1949, *Ludlow, Sherriff & Hicks 19476*. Yuto La, 4,050–4,200 m., 21 July 1937, *Ludlow & Sherriff 3472*. Rudo La (west side), 3,600 m., 5 Aug. 1949, *Ludlow, Sherriff & Hicks 20980*. Singhi Kurted, 3,450 m., 3 Aug. 1915, *Cooper 4333*. Singhi Dzong, Khoma Chu, 4,050 m., 17 Aug. 1933, *Ludlow & Sherriff 467* ; 2,400 m., 21 July 1949, *Ludlow, Sherriff & Hicks 21314*.

S.E. TIBET : Nyenchengtang La, 4,200 m., 20 June 1943, *Ludlow & Sherriff 9640*. Hills north of Lhasa, 4,650 m., 30 June 1942, *Ludlow & Sherriff 8773* ; 4,200 m., 12 July 1943, *Ludlow & Sherriff 9788*. Hills south of Lhasa, 4,200 m., 6 June 1942, *Ludlow & Sherriff 8664*. Reting, 60 miles north of Lhasa, 4,350 m., 12 July 1944, *Ludlow & Sherriff 9982*. Lhakang, 3,750 m., 1 Sept. 1933, *Ludlow & Sherriff 511*. Lukuthang, Mago, 4,050 m., 3 Aug. 1934, *Ludlow & Sherriff 808*. Le La, Chayul–Charme, 4,500 m., 4 July 1936, *Ludlow & Sherriff 2291*. Kashong La, Chayul Chu, 3,750 m., 21 July 1936, *Ludlow & Sherriff 2409*. Lochen La, 3,900–4,500 m., 21 Aug. 1935, *Kingdon-Ward 12260*. Ba La, Pasum Chu, 4,050 m., 1 July 1947, *Ludlow, Sherriff & Elliot 14042*. Nambu La, 4,500 m., 14 July 1947, *Ludlow, Sherriff & Elliot 15445*. Tsanang La, near Paka, 3,600 m., 19 July 1938, *Ludlow, Sherriff & Taylor 5879*. Sang La, 4,050 m., 29 June 1938, *Ludlow, Sherriff & Taylor 5056* ; 12 Sept. 1938, *Ludlow, Sherriff & Taylor 5056a*. Deyang La, 4,050 m., 8 Aug. 1947, *Ludlow, Sherriff & Elliot 14276*. Tumbatse, 3,500 m., 2 July 1938, *Ludlow, Sherriff & Taylor 5104*. Doshong La, 3,150 m., 24 June 1947, *Ludlow, Sherriff & Elliot 15312*. Valley above Tripe, 3,600 m., 25 July 1938, *Ludlow, Sherriff & Taylor 5403*. Tongkyuk, Pome Snow Range, 3,600 m., 1 Aug. 1935, *Kingdon-Ward 12107*.

First described as a species from narrow-leaved specimens collected by Antwerp E. Pratt in the neighbourhood of Tatsienlu (Kangting), *A. prattii* had earlier been recorded from Sikkim under the name of *A. victorialis* var. *angustifolium* by Hooker. *A. victorialis* was founded by Linnaeus on European material and plants essentially similar to those of Central Europe and the Caucasus, having usually three or four broad leaves sheathing the flower-stem and whitish flowers, have spread along the western Himalaya to the Kumaun-Nepal border. The leaves of *A. victorialis* are plicately folded when young. Plants recorded as *A. victorialis* from the Eastern Himalaya belong to *A. prattii*. This has usually two, rarely three, more or less basal leaves and the flowers are rose or red. When travelling in May 1945 between Tangu and Talam in upper Sikkim I noted in numerous plants that the young leaves have their margins inrolled but are not markedly plicate like those of cultivated European plants. Here in Sikkim it grows in deep leaf-mould and alluvial soil beneath bushes of *Betula*, *Rhododendron*, *Rosa* and *Salix* and the field notes of other observers indicate it as growing elsewhere among bushes, in deciduous forest and in damp alpine meadows, with flowers varying from " pale pink " to " deep wine red " or reddish-purple, very rarely to white. No other species of *Allium* is so protean in leaf shape. At one extreme are specimens with almost linear leaves down to 0·5 cm. broad (e.g. *Ludlow & Sherriff 2291*), at the other extreme specimens with more or less narrowly elliptic leaves up to 6 cm. broad (e.g. *Forrest 30504* from Yunnan) recalling those of *A. victorialis*.

The inhabitants of upper Sikkim gather the leaves of *A. prattii* for seasoning curries.

2. **Allium przewalskianum** Regel, Allior. Monogr. : 164 (1875).

Allium junceum Jacquem. ex Bak. in Journ. of Bot. xii : 295 (1874) ; non *A. junceum* Sm. (1809).

Allium stoliczki Regel, op. cit. : 160 (1875).—Stearn in Herbertia xii : 78 (1947).

Allium jacquemonti Regel, op. cit. : 162 (1875) ; non *A. jacquemontii* Kunth (1843).—Hook. f., Fl. Brit. Ind. vi : 342 (1892).—Marquand in Journ. Linn. Soc. Lond., Bot. xlviii : 226 (1929).

CENTRAL NEPAL : Damodar Kund, north of Muktinath, 4,200 m., 31 July 1954, *Stainton, Sykes & Williams 2109.*

S.E. TIBET : Dochen, 4,200 m., 7 Aug. 1936, *Chapman 492* (Herb. Kew.) Atsa Tso, 3,900–4,200 m., 26 Aug. 1924, *Kingdon-Ward 6147* (Herb. Kew.).[1]

This species was first discovered by Victor Jacquemont at " Ghoyoumal " (roughly 32° 20′ N., 75° 30′ E.) in the Punjab Himalaya but the name *A. junceum*, given by him in manuscript and subsequently published by Baker, had already been used for a Cyprus species. Regel accordingly renamed the species *A. jacquemonti*, ignoring the earlier *A. jacquemontii* of Kunth. At the same time Regel described as new two species, *A. stoliczki* based on a very imperfect specimen collected by Ferdinand Stolicza, the provenance not given but probably Ladakh, and *A. przewalskianum* based on good material collected by N. M. Przewalski in Kansu, both of which appear to be conspecific with his *A. jacquemonti.*

The species can be recognized by its bright-red finely reticulate bulb-coat, narrow leaves and small purplish flowers with protruding stamens, the inner three filaments having a broad oblong base with a tooth on each side at the top and a slender upper part, while the three outer filaments are subulate. A plant of arid regions, it has many times been collected in Little Tibet (Ladakh and Baltistan) and in Kansu. The records given above help to connect these areas. *A consanguineum* Kunth comes very close to it but has a duller brown bulb-tunic, somewhat broader leaves and the inner filaments with an ovate base. *A. eduardi*[2], recorded from the Altai, Dzungaria and Mongolia, likewise differs in the ovate base of the inner filaments but otherwise is almost identical judging from the one specimen examined. *A. nuristanicum* Kitamura in Act. Phytotax. & Geobot. xvii : 142 (1958), from Afghanistan, is also closely akin, according to the description.

3. **Allium carolinianum** DC. in Redouté, Liliac. ii : t.101 (1804).—Stearn in Herbertia xii : 76 (1947).

Allium blandum Wall., Pl. As. Rarior. iii : 38, t. 260 (1832).—Kunth, Enum. Pl. iv : 396 (1843).—Bak. in Journ. of Bot. xii : 295 (1874).—Regel, Allior. Monogr. : 129 (1875).—Hook. f., Fl. Brit. Ind. vi : 339 (1892).—Wendelbo in Biol. Skr. Dansk. Vid. Selsk. x, 3 : 171, fig. 60 (1958).

Allium polyphyllum Kar. & Kir. in Bull. Soc. Imp. Nat. Mosc. xv : 509 (1842).—Regel, loc. cit. (1875).—Vvedensky in Fl. URSS iv : 176 (1935), transl. in Herbertia xi : 129 (1946).

---

[1] The following record is from further east in Tibet : Shugden Gompa, Nagong, 3,900–4,200 m., 26 July 1933, *Kingdon-Ward 10648.*

[2] ALLIUM EDUARDI Stearn in Herbertia xi : 102 (1946).

Allium fischeri Regel, Allior. Monogr. : 161 (1875) ; non *A. fischeri* Bess. (1830).—Krylow, Fl. Zapad. Sib. iii : 624 (1929).—Vvedensky in Komarov, Fl. URSS iv : 145 (1935).

Allium obtusifolium Klotzsch in Klotzsch & Garcke, Bot. Ergebn. Reise Prinz. Waldemar: 51, t. 95 (1862).—Regel, op. cit.: 128 (1875).
Allium thomsoni Bak., tom. cit.: 294 (1874).—Regel, op. cit.: 140 (1875).—Hook. f., tom. cit.: 340 (1892).
Allium aitchisoni Boiss., Fl. Or. v: 248 (1882).

WESTERN NEPAL: Urai Lagna (Nepal-Tibet frontier), 5,100 m., 8 July 1953, *Tyson 86*.

CENTRAL NEPAL: Khangsar, 4,800 m., 27 July 1950, *Lowndes 1262*.

Although nothing is known of how a species characteristic of the Western Himalaya and Central Asia came to be grown in Paris by 1804, the cultivated plant described by De Candolle as *A. carolinianum*, under the impression that it had been introduced from Carolina by L. A. G. Bosc, is identical with the Himalayan species later named *A. blandum* by Wallich and there is no alternative to adopting the earlier though misleading name. Sereno Watson pointed out in 1879 (in Proc. Amer. Acad. Arts & Sci. xiv: 234) that the species was not known in America.

This species includes *A. obtusifolium* and *A. thomsoni*, both based on Himalayan specimens; and Wendelbo (1958) has recently shown that *A. aitchisoni*, from Afghanistan, and *A. polyphyllum*, described from material collected in the Dzungarian Ala-Tau, are also to be united with it. *A. carolinianum* thus extends southward from the Dzungarian Ala-Tau over the mountains of Central Asia into Afghanistan (Nuristan, Kurram) and from Gilgit over Kashmir to Nepal.

4. **Allium stracheyi** Bak. in Journ. of Bot. xii: 293 (1874).—Regel, Allior. Monogr. 134 (1875).—Hook. f., Fl. Brit. Ind. vi: 340 (1892).

WESTERN NEPAL: Near Rohagaon, Suli Gad, 2,700 m., 13 Sept. 1952, *Polunin, Sykes & Williams 3347*. Between Pudamigaon and Ringmigaon, 3,900 m., 22 Sept. 1952, *Polunin, Sykes & Williams 3550*.

The type specimen of *A. stracheyi* was collected by Richard Strachey and J. E. Winterbottom in 1848 in the Kumaun Himalaya at Ralam. Sir Richard Strachey's "Narrative of a journey to the lakes Rakas-tal and Manasarowar, in Western Tibet, undertaken in September 1848" received belated publication in Geogr. Journ. xv: 150–170, 243–264, 394–415 (1900); it has a map opposite p. 204 on which not only their routes of 1846, 1848 and 1849 are marked but also Moorcroft's of 1812.

A. stracheyi is a characteristic West Himalayan species extending from Kashmir to Western Nepal. The large nectarial pits on the ovary covered above by a hood-like projection associate it, however, with such eastern species as *A. chinense* G. Don[1] and *A. thunbergii* G. Don (*A. japonicum* Regel).

---

[1] ALLIUM CHINENSE G. Don, Monogr. Allium: 83 (1827), reimpr. in Mem. Werner. Nat. Hist. Soc. vi: 83 (1832).—Kunth, Enum. Pl. iv: 454 (1843).
Allium triquetrum sensu Lour., Fl. Cochinch. i: 202 (1790); non L.
Caloscordum exsertum Lindl. in Edw., Bot. Regist. xxxiii: sub t. 5 (1847).
Allium exsertum (Lindl.) Bak. in Journ. of Bot. xii: 294 (1874); non *A. exsertum* G. Don (1827).
Allium bakeri Regel, Allior. Monogr.: 141 (1875).—Hook. f., Fl. Brit. Ind. vi: 341 (1892).

This species is not known from the Himalaya but occurs in the Khasi Hills of Assam, to which it may well have been introduced from China, where, as in Japan, it is a culinary onion of importance. Many hundreds of tons of the bulbs are exported every year from China and Japan, although it is not mentioned at all in the detailed survey by J. Helm (1956) of onion and garlic crops, and Prokhanov (1930) attributed its Chinese name *hiai* to *A. fistulosum* L. Its economic value, cultivation, history and synonymy are to be discussed elsewhere (Mann & Stearn, ined.).

5. **Allium chrysanthum** Regel, Allior. Monogr.: 91 (1875); in Act. Hort. Petrop. x : 313 (1887).

S.E. TIBET : South of the Gyalam, Tsangpo Valley, 4,200–4,500 m., 31 Aug. 1935, *Kingdon-Ward 12278*.

Hitherto recorded only from the type locality in southern Kansu, where it was first collected by Przewalski and later by Licent (n. *4541*) and J. F. Rock (ns. *13037*, *13704* ; Herb. Kew), *A. chrysanthum* is evidently a widely spread and variable but infrequently gathered plant. Przewalski's material varied from 20 to 35 cm. in height, Rock's from 35 to 50 cm. Rock's field-notes (n. *13037*) describe the flower heads as " golden yellow " but E. H. Wilson (n. *4688*) recorded them as " creamy-white " and Kingdon-Ward (n. *12278*) as " cream " ; in a dried state the flowers are a light glistening yellow.

6. **Allium phariense** Rendle in Journ. of Bot. xliv : 42 (1906).—Stearn in Herbertia xii : 84 (1947). (Fig. 10 *e*.)

S.E. TIBET : Po-ting La, 2 miles north of Phari, 16 Aug. 1878, *Dungboo* (holotype in Herb. Brit. Mus.). Yatung, 3,000 m., 8 Aug. 1936, *Chapman 711* (Herb. Kew). Rama, 4,800 m., 29 June 1939, *Gould 2206* (Herb. Kew).

A. phariense as represented by the above specimens rises not more than 9 cm. above the top of the bulb, whereas *A. chrysanthum*, according to Chinese material, varies between 20 cm. and 50 cm. in height. In most characters they resemble each other so closely that until Chapman's material became available it seemed reasonable to regard Dungboo's specimens as abnormally dwarfed ones of *A. chrysanthum*. Chapman's specimens collected 25 miles from the type locality are equally dwarf but show that in a fresh state the flowers are reddish although they later fade. There are also small differences in the poise of the leaves, which are spreading and somewhat curved in *A. phariense* and almost erect and straight in *A. chrysanthum*, and in the texture and colour of the bulb-coats. Gould's specimens are in bud.

7. **Allium kingdonii** Stearn, sp. nov. (Fig. 10 *a* ; Plate 9.)

Bulbus cylindricus, angustus, c. 6 mm. diam., rhizomati brevi descendenti insidens, tunicis interioribus membranaceis flavescentibus, exterioribus pallide brunneis in lacinias 1·5–3 cm. longas longitudinaliter fissis ; caulis gracilis, teres, 10–30 cm. altus, c. 1–2·5 mm. diam. *Folia* 3–6, subbasalia, scapo breviora, linearia, plana, 6–20 cm. longa, 1·5–4 mm. lata, apice acuta. *Spatha* cito caduca, univalvis, rubra, c. 1·5 cm. longa ; umbella laxa, 1–5-flora ; pedicelli inaequales, 7–15 mm. longi. *Perianthium* campanulatum ; tepala erecta, anguste oblonga, apice obtusa, purpurea, exteriora 13–16 mm. longa et 4 mm. lata, interiora 14–18 mm. longa et 3·5 mm. lata. *Stamina* inclusa, quam perianthium dimidio breviora ; filamenta simplicia, filiformia, alba, exteriora per 1 mm. cum basi tepali connata parte libera c. 5 mm. longa, interiora per 2 mm. cum basi tepali connata parte libera c. 4–5 mm. longa, antherae purpureae, c. 0·5–0·7 mm. longae. *Ovarium* laeve ; ovula in quoque loculo 2 ; stylus subulatus, purpurascens, ad 2·5 mm. longus, apice brevissime trifidus.

S.E. Tibet : Mira La, Nyang Chu, 4,350 m., 13 Aug. 1938, *Ludlow, Sherriff & Taylor 6044*. Nambu La, 4,800 m., 31 Aug. 1938, *Ludlow, Sherriff & Taylor 6957* ; 4,350 m., 11 July 1947, *Ludlow, Sherriff & Elliot 15387* (holotype in Herb. Brit. Mus.). Sang La, 4,200 m., 27 June 1938, *Ludlow, Sherriff & Taylor 5021*. Sobhe La, 4,500 m., 2 Aug.

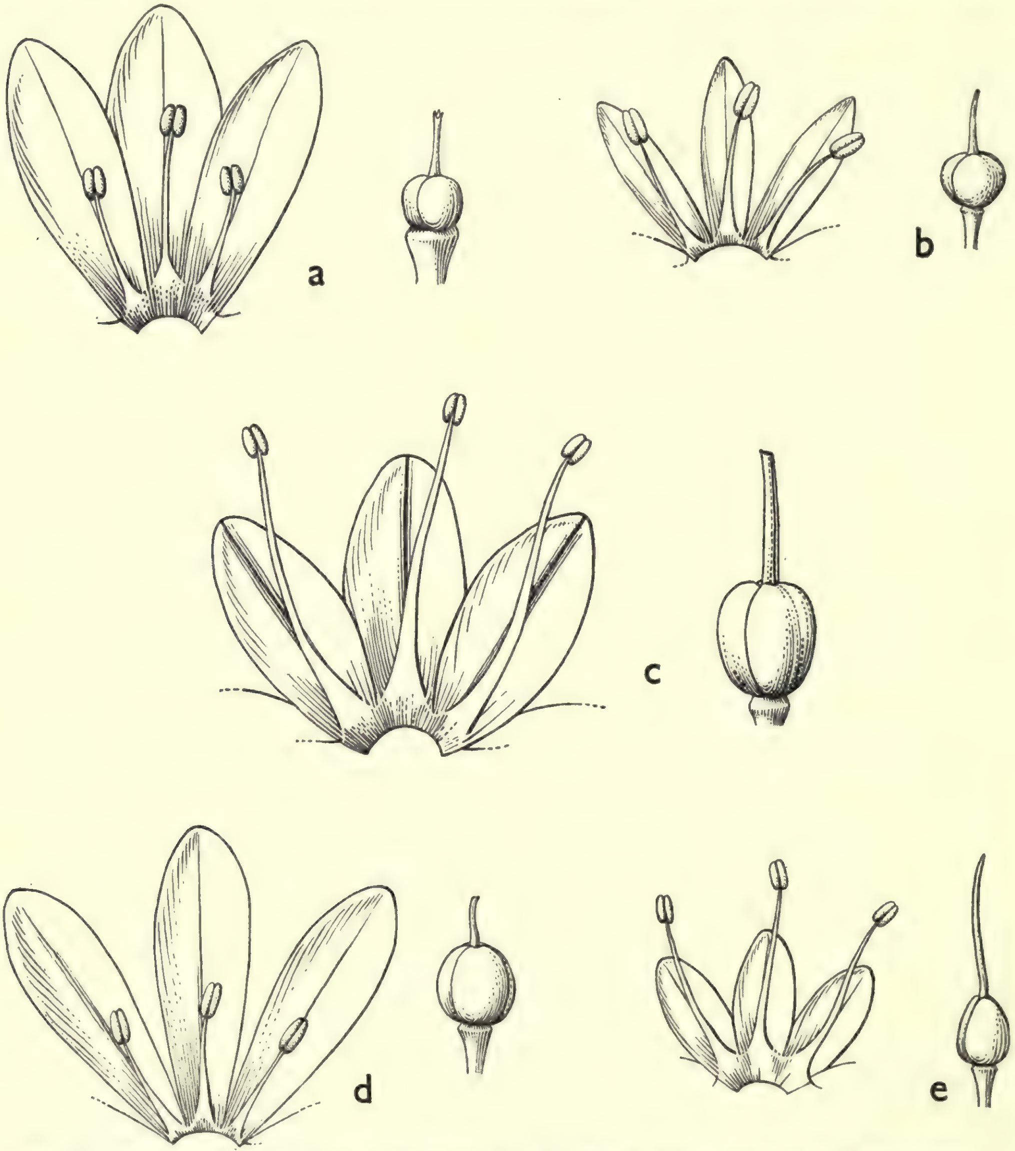


Fig. 10. Tepals, stamens and gynoecium of : *a, Allium kingdonii* Stearn (holotype : *Ludlow, Sherriff & Elliot 15387*) ; *b, Allium lancifolium* Stearn (isotype : *Forrest 2994*) ; *c, Allium rhabdotum* Stearn (holotype : *Ludlow, Sherriff & Hicks 21442*) ; *d, Allium acidoides* Stearn (holotype : *Kingdon-Ward 13209*) ; *e, Allium phariense* Rendle (holotype : *Dungboo*). (All × 3½.)

1935, *Kingdon-Ward 12122* ; 4,050 m., 5 July 1947, *Ludlow, Sherriff & Elliot 15344.* Nyima La, 4,200–4,500 m., 2 July 1924, *Kingdon-Ward 5891* (Herb. Kew). Kashong La (Chang La), 4,200 m., 17 July 1936, *Ludlow & Sherriff 2381.*

The above-listed specimens of this beautiful species all come from the Pome and Kongbo regions of south-eastern Tibet, roughly between 29° 30′ and 30° 10′ N., 94° and 95° E., where it was first discovered by Frank Kingdon-Ward. In 1937 Fa-Tsuan Wang and Tsin Tang, according to a note in the Kew Herbarium, recognized Kingdon-Ward's specimen from Nyima La as representing an undescribed species but probably owing to its inadequacy they did not describe it. The abundant material now to hand confirms its distinctness and *Ludlow, Sherriff & Elliot 15387*, rather than *Kingdon-Ward 5891*, is accordingly designated as type. The flowers are described by the collectors as being " pinkish purple " (*L., S. & E. 15387*), " light mauve " (*L., S. & E. 15344*), " magenta-purple " (*L., S. & T. 5021*), " purplish crimson, tube dark purple " (*L., S. & T. 6957*) and " wine red " (*L., S. & T. 6044*). The habitat is variously recorded as being " on open rocky hillside, and grassy cliff ledges " (*L., S. & T. 6044*), " amongst rocky precipices " (*L., S. & T. 6957*), " on grassy banks at margin of scree " (*L., S. & T. 5021*), " on rocks " (*L., S. & E. 15344*), " in moist ground " (*L., S. & E. 15387*) and " in open alpine pastures " (*K.-W. 5891*). To this species may belong material collected in bud by J. F. Rock (n. *10367*) in 1923 at 4,050 m. on the mountains of Londjre, Mekong-Salween watershed, north-western Yunnan.

Although close to *A. forrestii* Diels[1] the new species differs in its membranous bulb-coat which breaks up into strips, its very uneven pedicels of which at least one is longer than the perianth and its somewhat larger flowers which are 14–18 mm. long. The bulb-coat of *A. forrestii* breaks up into more or less parallel fibres and the pedicels are shorter than its flowers which are 10–15 mm. long.

8. **Allium mairei** H. Lév. in Fedde, Repert. Nov. Sp. vii : 339 (1909).—Airy-Shaw in Not. R. Bot. Gard. Edinb. xvi : 146 (1931).

Allium yunnanense Diels in Not. R. Bot. Gard. Edinb. v : 301 (1912).—Marquand in Journ. Linn. Soc. Lond., Bot. xlviii : 226 (1929).

S.E. TIBET : Nambu La, 3,000 m., 2 Sept. 1938, *Ludlow, Sherriff & Taylor 6975.* Yigrong Gorge, 2,700–3,000 m., 9 Aug. 1935, *Kingdon-Ward 12177.* Tongkyuk, 2,700–3,000 m., 10 Aug. 1924, *Kingdon-Ward 6076* (Herb. Kew).

First described by Hector Léveillé in 1909, with a characteristically inadequate diagnosis, from specimens collected in Yunnan by Edouard E. Maire in 1906, this species was again described in 1912 under the name *A. yunnanense* by Diels from several gatherings collected by Forrest in Yunnan. In February 1931 Airy-Shaw established the identity of *A. mairei* and *A. yunnanense*, at the same time referring to his own *A. pyrrhorrhizum* one of Forrest's gatherings (n. *3049*) that had been cited by Diels under *A. yunnanense*. Soon afterwards Stapf in Curt., Bot. Mag. clv : t. 9257 (October 1931), took from the specimens referred by Airy-Shaw to *A. pyrrhorrhizum* a further segregate, *A. amabile* Stapf based on *Forrest 22001* and *22356*. Possibly the close affinity of these plants might best be expressed by giving them varietal rank under *A. mairei*. Another allied plant is *A. acidoides* Stearn.[1]

---

[1] ALLIUM FORRESTII Diels in Not. R. Bot. Gard. Edinb. v : 302 (1912).

S.E. TIBET : Shugden Gompa, near the Ata Kang La, 4,200–4,500 m., 3 Sept. 1933, *Kingdon-Ward 10809.* BURMA : Adung Valley, 28° 20′ N., 97° 40′ E., 3,900–4,200 m., 12 Aug. 1931, *Kingdon-Ward 9922.*

The type gathering of this species is *Forrest 3038* from crevices and grassy ledges of cliffs at 3,000–3,600 m. on the eastern flank of the Lichiang Range in Yunnan, collected in 1906. Subsequent collecting has shown it to extend along the Mekong-Salween divide between 27° 30′ and 28° 40′ N. Kingdon-Ward's material cited here is the most western yet known.

9. **Allium sikkimense** Bak. in Journ. of Bot. xii: 292 (1874).—Regel, Allior. Monogr. : 146 (1875).—Hook. f., Fl. Brit. Ind. vi : 341 (1892).—C. H. Wright in Curt., Bot. Mag. cxvi : t. 8858 (1920).

Allium cyaneum var. *brachystemon* Regel in Act. Hort. Petrop. x : 346, t. 4 figs. 3, *3a*, *3b* (1887).

Allium kansuense Regel, tom. cit. : 690 (1889) ; in Gartenflora xxxix : t. 1379 (1890).—Bak. in Curt., op. cit. cxix : t. 7290 (1893).—C. H. Wright apud Forbes & Hemsl. in Journ. Linn. Soc. Lond., Bot. xxxvi : 123 (1903).—Sm. & Cave in Rec. Bot. Surv. Ind. iv : 247 (1911).—Marquand in Journ. Linn. Soc. Lond., Bot. xlviii : 226 (1929).

Allium tibeticum Rendle in Journ. of Bot. xliv : 41 (1906).—Stearn in Herbertia xii : 84 (1947).

CENTRAL NEPAL : Jargeng Khola, 4,350 m., 2 Aug. 1950, *Tilman* for *Lowndes 1321* ; 5 Aug. 1950, *Lowndes 1326*.

SIKKIM : Tangu, 4,200 m., *Hooker 10* in part (lectotype in Herb. Kew). Kangra Lama, 5,100 m., 14 Aug. 1909, *Smith & Cave 2445*. Lachen, 3,000–3,300 m., *Hooker 10* in part (Herb. Kew). Cholamo, 4,800 m., 6 Sept. 1911, *Ribu & Rohmoo 5474* (Herb. Kew).

BHUTAN : Between Barshong and Dotena, Thimbu Chu, 3,000 m., 16 Oct. 1949,

---

[1] **Allium acidoides** Stearn, sp. nov. (Fig. 10 *d* ; Plate 10.)

Herba caespitosa ; bulbus cylindricus, angustissimus, c. 3 mm. diam., rhizomati brevi descendenti insidens, tunicis membranaceis, exterioribus annotinis in fibras parallelas griseas c. 3–5 cm. longas dissolutis ; caulis gracilis, c. 12–15 cm. altus, 0·5–1 mm. diam., glaber. *Folia* 2–4, subbasalia, plus minusve erecta, scapo breviora vel eum aequantia ; vagina striata, 3–3·5 cm. longa ; lamina angustissime linearis, c. 9–1·3 cm. longa, 1–1·5 mm. lata. *Spatha* cito decidua, c. 8 mm. longa ; umbella laxa, 1–4–flora ; pedicelli ascendentes, plerumque curvati, 2–3·5 cm. longi. *Perianthium* campanulatum ; tepala ascendentia, oblanceolata, apice obtusa, superne alba sed basin versus rosea, nervo medio rubro percursa, c. 10–12 mm. longa, 3·5–4 mm. lata. *Stamina* inclusa, c. 4 mm. longa, c. tertiam partem perianthii aequantia ; filamenta simplicia, subulata, alba, inferne gradatim dilatata, exteriora per 0·5 mm. cum basi tepali connata parte libera c. 3·5 mm. longa, interiora per 1 mm. cum basi tepali connata parte libera c. 3 mm. longa ; antherae post dehiscentiam purpureae c. 1 mm. longae. *Ovarium* subglobosum ; ovula in quoque loculo 2 ; stylus subulatus, c. 1·5 mm. longus, apice indivisus.

BURMA : Nam Tamai Valley, 28° N., 97° 45′ E., 2,700–3,000 m., 9 Sept. 1937, *Kingdon-Ward 13209* (holotype in Herb. Brit. Mus.). Mungku Hyet, 27° 45′ N., 97° 50′ E., 2,700 m., 23 Aug. 1937, *Kingdon-Ward 13024*.

This comes very near *A. mairei* and is with hesitation separated from that species on account of the frequently curved pedicels and " hanging flowers ", broader tepals, shorter stamens, dark anthers and subglobose ovary. Kingdon-Ward found it " very common on the cliffs of a precipitous rocky gulley " (n. *13209*) and " on the grassy ledges of a rock scupper above the moss forest " (n. *13024*), and described it in his field-notes as " a beautiful little rock plant, the modest hanging flowers almost suggesting snowdrops ". It resembles in habit rather more the narrow-leaved snowflakes, *Leucojum autumnale* and allies, forming *Leucojum* subgen. *Acis*, which Salisbury, Sweet, Herbert, Jordan and Fourreau maintained as a genus *Acis* distinct from *Leucojum*, than it does the true snowdrops (*Galanthus*); hence the epithet *ăcĭdŏīdēs* (from the mythical Acis, Ἄκις, son of Faunus) is proposed for it. In *A. mairei* the flowers are held stiffly erect and the stamens are more than half the length of the tepals ; the anthers are yellowish and the ovary is more distinctly narrowed above and below the middle. The shorter stamens of *A. acidoides* likewise distinguish it from *A. amabile* and *A. pyrrhorrhizum*.

Ludlow, Sherriff & Hicks 17530. Thampe Tso, 4,650 m., 13 Aug. 1949, *Ludlow, Sherriff & Hicks 17124*. Kurmathang, Bumthang, 3,900 m., 23 Sept. 1914, *Cooper 2215*. Pangothang, Tsampa, 3,750 m., 8 Sept. 1949, *Ludlow, Sherriff & Hicks 19694*.

S.E. Tibet : Near Naku La, 28 July–8 Aug. 1903, *Younghusband 178*. East of Phari, 4,500 m., 16 Aug. 1938, *Gould 1499* (Herb. Kew). Phile La, 4,500 m., 23 July 1914, *Cooper 1712*. Karo La, 13 Aug. 1878, *Dungboo* ; 4,950 m., July 1904, *Walton* (lectotype of *Allium tibeticum* in Herb. Brit. Mus.). Dzara, 4,500–4,800 m., 18 Aug. 1936, *Chapman 216* (Herb. Kew). Hills south of Lhasa, 4,500 m., 19 Aug. 1943, *Ludlow & Sherriff 9887*. Pass south of Lhasa, 3,900 m., 20 Sept. 1936, *Chapman 703* (Herb. Kew). Ganden, 25 miles east of Lhasa, 4,200 m., 21 Sept. 1943, *Ludlow & Sherriff 9937*. Reting, 60 miles north of Lhasa, 3,750 m., 1939, *Lachag Taring*; 3,900 m., 30 July 1942, *Ludlow & Sherriff 8965* ; 4,200 m., 3 Aug. 1944, *Ludlow & Sherriff 11103*. Bod La, 4,500 m., 30 Aug. 1933, *Ludlow & Sherriff 496*. Between Me La and Cho La, 3,750 m., 21 Aug. 1949, *Ludlow, Sherriff & Hicks 21410*. Mago, Mönyul, 3,600–3,900 m., 8 Aug. 1934, *Ludlow & Sherriff 778* ; 4,200 m., 4 Oct. 1935, *Kingdon-Ward 12387*. Trakan La, Char Chu, 3,900–4,500 m., 11 Aug. 1936, *Ludlow & Sherriff 2010*. Molo, Lilung Chu, 3,150 m., 30 Sept. 1938, *Ludlow, Sherriff & Taylor 6542*. Lilung Chu, 3,250 m., 3 Oct. 1938, *Ludlow, Sherriff & Taylor 7168*. Pangkar, Drukla Chu, 3,450 m., 20 Aug. 1938, *Ludlow, Sherriff & Taylor 6867*. Nyoto Sama, Upper Yigrong, 3,900 m., 10 Aug. 1947, *Ludlow, Sherriff & Elliot 15588*. Deyang La, 3,900 m., 8 Aug. 1947, *Ludlow, Sherriff & Elliot 14253*; 3,600 m., 11 Aug. 1947, *Ludlow, Sherriff & Elliot 14316*. Nam La, 4,200–4,500 m., 26 July 1924, *Kingdon-Ward 6015* (Herb. Kew).

The light blue flowers of *A. sikkimense* readily distinguish it from other Himalayan species. Of the two blue-flowered species of western China *A. cyaneum* Regel (see Curt., Bot. Mag. clx : t. 9483) differs in having conspicuously exserted stamens, *A. beesianum* W. W. Sm. (Curt., op. cit. clvi : t. 9331) in having much larger flowers in a nodding umbel.

10. **Allium tuberosum** Rottl. ex Spreng. in L., Syst. Veg., ed. 16, ii : 38 (1825).—Stearn in Herbertia xi : 239, tt. 264–266 (1946).—E. H. Moore in Baileya ii : 117, 120 (1955).

Allium sinicum Nor. in Verh. Batav. Genootsch. v, 4 : 6 (1790), *nom. nud.*
Allium tuberosum Roxb., Hort. Bengal. : 24 (1814), *nom. nud.*
Allium sulvia Buch.-Ham. ex D. Don, Prodr. Fl. Nepal. : 53 (1825).
Allium tuberosum Roxb., Fl. Ind. ii : 141 (1832) ; non *A. tuberosum* Rottl. ex Spreng. (1825).—Hook. f., Fl. Brit. Ind. vi : 343 (1892).
Allium roxburghii Kunth, Enum. Pl. iv : 454 (1843).
Nothoscordum? sulvia (Buch.-Ham. ex D. Don) Kunth, tom. cit. : 462 (1843).
Allium fragrans sensu Regel, Allior. Monogr. : 217 (1875) pro parte ; non Vent.
Allium odorum sensu Hook. f., loc. cit. (1892) ; non L.

Western Nepal : Nampa Gadh, 3,600–3,900 m., 27 July 1886, *Duthie 6048*. Mugu Karnali Valley, between Mangri and Daura, 2,550 m., 16 Aug. 1952, *Polunin, Sykes & Williams 5253*. Dunaihi, Bheri Valley, 2,350 m., 16 July 1952, *Polunin, Sykes & Williams 2475*.

CENTRAL NEPAL : Tukucha, Kali Gandaki, 2,550 m., 5 June 1954, *Stainton, Sykes & Williams 941*. Larjung (south of Tukucha), Kali Gandaki, 2,400 m., 23 July 1954, *Stainton, Sykes & Williams 1982* ; 2,700 m., 16 Oct. 1954, *Stainton, Sykes & Williams 8158*.

A. tuberosum is widespread in eastern Asia. For many centuries it has been cultivated, notably by the Chinese, as a salad plant and in some places it may have escaped from cultivation, thus obscuring its natural range. It occurs in the Khasi Hills of Assam.

Since the nomenclature of this species was discussed in 1946 (Stearn, 1946) it has been found that the name *A. sulvia* (and the combination *Nothoscordum sulvia*) should be added to the synonymy. David Don published this with a description inadequate by itself for recognition of the plant concerned :

> 1. *A. Sulvia*, foliis latè linearibus planis glabris, scapo tereti laevi, umbellâ patulâ multiflorâ.
> Allium Sulvia. *Hamilton MSS.*
> *Hab.* ad Suembu in Nepalia superiore. *Hamilton.* ♃. Floret Julio.
> *Scapus* pedalis. *Folia* lorata, viridia. *Flores* parvi.

There is no specimen typifying it in the 674 specimens collected by Francis Buchanan (later Hamilton) which the British Museum acquired at Lambert's sale in 1842. The Lambert collection studied by Don duplicated, however, a collection given earlier by Buchanan to Sir James E. Smith, as stated by Buchanan in a letter of 16 Oct. 1821 quoted by Prain, *Sketch of the Life of Francis Hamilton* (*once Buchanan*) : xxxi (1905) : " A great part of what I have done there [in Nepal] has been in a sort lost as having been given to Sir J. E. Smith who is rather indolent and not likely to publish any considerable part of what he has. A Mr. Don, however, who lives with Mr. Lambert, to whom I gave duplicates of the collection presented to Sir J. E. Smith, is engaged in publishing an account of them ". The Smith herbarium, now at the Linnean Society of London, contains a specimen (583.38) which is evidently an isotype of Don's *A. sulvia*, with a label in Buchanan's hand : " Allium Suloca B. Suimbu 11th July, 1802 ". From this it would appear that Don's epithet *Sulvia* is an error of transcription. The locality Suimbu, now Svayambhunath, is a holy place a few miles from Katmandu in the Valley of Nepal ; Buchanan was stationed at Katmandu from April 1802 to March 1803. His specimen has reticulate bulb-coats, leaves about 3 mm. broad and a loose umbel of white flowers with spreading tepals about 4·5 mm. long ; it agrees with a Calcutta specimen of *A. tuberosum* from Roxburgh which is also in Smith's herbarium (583.21). Don's *Prodromus* was published in February 1825 (cf. Stearn in Journ. Arnold Arb. xxvi : 168 (1945)). Whether the name *A. tuberosum* Rottl. ex Spreng., which also dates from 1825, was published earlier or later than this is uncertain. In the absence of definite evidence, the well-known name *A. tuberosum* is retained here.

In 1825 Lindley (in Edw., Bot. Regist. xi : t. 898) figured as *A. fragrans β Nepalense* a plant raised from seed presented by the Hon. East India Company and apparently a form of *Nothoscordum inodorum* (Ait.) Nicholson, which is unknown in Nepal.

Lindley stated, however, that the " *Allium Sulvia* found in Nepal by Dr. Hamilton seems to be nearly related to this, but we have seen no specimen of it ". Acting on this misleading hint, Kunth in 1843 transferred *A. sulvia* to the genus *Nothoscordum.* J. D. Hooker (Fl. Brit. Ind. vi : 337) in 1892 with just as little information as Kunth referred it to *A. ascalonicum* L., meaning by that a cultivated shallot, i.e. a cultivar of *A. cepa* L. The name *A. ascalonicum* has been a source of confusion almost since its first publication by Linnaeus in his dissertation *Flora Palaestina* : 17 (1756), reprinted in Amoen. Acad. iv : 454 (1759), and certainly since his treatment of it in the *Species Plantarum*, ed. 2, i : 429 (1762), which covers two very distinct plants. When Linnaeus originally published the name *A. ascalonicum* in 1756 he based his definition solely on a wild Palestinian species collected by Hasselquist in 1751. Hasselquist probably gathered this between Jerusalem and Jericho in April 1751, certainly not at Ashkelon (to which the epithet *ascalonicum* refers) which he never visited. His two flowering specimens in the Linnaean Herbarium (sheet n. 419.24) lack bulbs but agree in habit and in floral structure with *A. hierochuntinum* Boiss., Fl. Or. v : 244 (1882), their tepals being lanceolate, acute and 5·5–6·5 mm. long, their stamens much shorter than the tepals, with the lateral cusps of the inner stamens somewhat longer than the central anther-bearing cusp. *A. hierochuntinum* is the only Palestinian Allium with blue flowers. The original colour of Hasselquist's specimens is no longer evident but while they were comparatively fresh Linnaeus (1762) described them as having " petala erecta, ovato-lanceolata, caerulea, carina atro-caerulea ". The type locality of *A. hierochuntinum* is the region between Jerusalem and Jericho (to which the epithet *hierochuntinum* refers) traversed by Hasselquist in April 1751, and it flowers here in March and April. Apparently this species has never been in cultivation. Not surprisingly its identity with the original *A. ascalonicum* of Linnaeus has hitherto been overlooked. From the second edition of the *Species Plantarum* (1762) it would appear that Linnaeus then regarded Hasselquist's wild Palestinian material as the flowering state of an onion (evidently a variant of *A. cepa*) long grown in gardens, unknown in the wild, which flowered but rarely and was propagated by separation of the bulbs, since he added as a synonym the *Cepa sterilis* of Caspar Bauhin, the *Cepa Ascalonica* of Mattioli and other pre-Linnaean authors, which had these characteristics. The epithet *Ascalonica* refers to the town of Ashkelon in southern Palestine, whence the Greeks and Romans obtained the onion known to them as *κρομυον 'ασκαλωνιον* or *caepa ascalonia,* which was evidently a variant of *A. cepa* but different from Mattioli's, being propagated only by seed. From this the English name " shallot " is derived, but the shallots of present-day gardens, to which the name *A. ascalonicum* is now usually applied, are cultivars of *A. cepa* distinct from both the *Cepa Ascalonica* of Mattioli and the *caepa ascalonia* of Roman authors, as also from *A. hierochuntinum.* The confusion associated with the name *A. ascalonicum* will certainly become worse if that name is now restored to the species represented by Linnaeus's type material of 1756, i.e. *A. hierochuntinum* Boiss. The name *A. hierochuntinum* has been used for this species, since Boissier, by Oppenheimer in Bull. Soc. Bot. Genève, Sér. 2, xxii : 275 (1931), Dinsmore in Post, Fl. Syria, ed. 2, ii : 637 (1933), and Feinbrun in Palest. Journ. Bot., Jerusalem Ser. iii : 20, fig. 33 (1943), and there has never been any uncertainty about it. The rejection of the name *A. ascalonicum* as a source of error persisting over two centuries is recommended in accordance with the International Code, Art. 65 (1956).

11. **Allium wallichii** Kunth, Enum. Pl. iv : 443 (1843).—Bak. in Journ. of Bot. xii : 291 (1874).—Regel, Allior. Monogr. : 142 (1875) excl. syn. *A. hookeri*.—Hook. f., Fl. Brit. Ind. vi : 341 (1892).—Sm. & Cave in Rec. Bot. Surv. Ind. iv : 247 (1911).—Kitamura in Kihara, Fauna & Fl. Nepal Himal. i : 91 (1955).

Allium coeruleum Wall., Numer. List : 177, n. 5070 (1832), *nom. nud.*
Allium violaceum Wall. ex Regel, op. cit. : 143 (1875), *nom. syn.*

WESTERN NEPAL : Below Mugu, Mugu Khola, 3,450 m., 24 Aug. 1952, *Polunin, Sykes & Williams 3018*. Lulo Khola, 4,650 m., 18 Sept. 1952, *Polunin, Sykes & Williams 3471*. Near Seng Khola, 3,450 m., 6 Oct. 1954, *Stainton, Sykes & Williams 4702*. North of Barse, 3,600 m., 14 Aug. 1954, *Stainton, Sykes & Williams 3854*.

CENTRAL NEPAL : Tukucha, Kali Gandaki, 2,850 m., 15 Sept. 1954, *Stainton, Sykes & Williams 7840* ; 3,000 m., 15 Oct. 1954, *Stainton, Sykes & Williams 8156*. Taglung, south of Tukucha, Kali Gandaki, 3,750 m., 12 July 1954, *Stainton, Sykes & Williams 1776*. Lete, south of Tukucha, Kali Gandaki, 2,400 m., 16 Sept. 1954, *Stainton, Sykes & Williams 7876*. Annapurna Himal, Seti Khola, 3,600 m., 28 July 1954, *Stainton, Sykes & Williams 6519*. Jargeng Khola, 4,200 m., 16 Sept. 1950, *Lowndes 1512*. Lamjung Himal, 4,200 m., 18 Sept. 1954, *Stainton, Sykes & Williams 8639*. Bimta Kothi, 3,900 m., 13 Sept. 1950, *Tilman* for *Lowndes 1542*. Pongsing, 1,800–3,900 m., 1929, *Lall Dhwoj 99* ; 4,200 m., 1929, *Lall Dhwoj 118*. Badza Dara, 2,250 m., 2 Sept. 1935, *Bailey's collectors*. Langtang Village area, 3,450 m., 2 Sept. 1949, *Polunin 1883, 1884*. Without precise locality, 1821, *Wallich 5070A* (isotype). Bheding, 3,600–3,900 m., 1930, *Lall Dhwoj 0323, 0324*.

EASTERN NEPAL : Tamur Valley, Ghunsa, east of Walungchung Gola, 3,600 m., 31 July 1956, *Stainton 1158*.

SIKKIM : Yakchi above Lachung, 3,000 m., 20 Aug. 1909, *Smith & Cave 2595*. Islumbo, 3,300 m., 24 Oct. 1875, *Clarke 25556*.

BHUTAN : Bela La, Paro, 3,000 m., 22 Aug. 1949, *Ludlow, Sherriff & Hicks 19630*. Foomay, upper Pho Chu, 3,600 m., 25 Sept. 1949, *Ludlow, Sherriff & Hicks 17289*. Ridang, Angdu Photrang, 3,000 m., 9 Sept. 1914, *Cooper 2033*. Gafoola, upper Pho Chu, 4,350 m., 7 July 1949, *Ludlow, Sherriff & Hicks 16768*. Tashigong, Kurted, 3,600 m., 23 Aug. 1915, *Cooper 4541*. Shingbe (Me La), 3,750 m., 28 Aug. 1949, *Ludlow, Sherriff & Hicks 21119*.

S.E. TIBET : Cho La, N.E. Bhutan frontier, 3,900 m., 24 Aug. 1949, *Ludlow, Sherriff & Hicks 21430*. Mago, Mönyul, 3,450 m., 7 Aug. 1934, *Ludlow & Sherriff 771* ; 3,300–3,600 m., 7 Oct. 1935, *Kingdon-Ward 12403*. Yarap, Tsari, 3,750–4,050 m., 22 Aug., 1936, *Ludlow & Sherriff 2474*. Shoga Dzong, 3,300 m., 18 Aug. 1938, *Ludlow, Sherriff & Taylor 6854*.

Kunth based his *A. wallichii* on *Wallich 5070A* from Central Nepal. The species is now known to extend eastward to western China, where it has close allies in *A. bulleyanum* Diels and *A. polyastrum* Diels, which differ from it in little but their rather fibrous bulb-coats, and *A. lancifolium* Stearn[1] which has differently shaped leaves.

12. **Allium hookeri** Thw., Enum. Pl. Zeyl. : 339 (1864).—Hook. f., Fl. Brit. Ind. vi : 341 (1892).—Trimen, Hand-book Fl. Ceyl. iv : 291 (1898).—Marquand in Journ. Linn. Soc. Lond., Bot. xlviii : 226 (1929).—Airy-Shaw in Not. R. Bot. Gard. Edinb. xvi : 138 (1931).—Bond, Wild Fl. Ceyl. Hills : 222, fig. 115 (1953).

Allium wallichii sensu Regel, Allior. Monogr. : 142 (1875) pro parte ; non Kunth.

BHUTAN : Bumthang, 3,000 m., 31 July 1949, *Ludlow, Sherriff & Hicks 19531.* Sherpang (Trashiyangsi Chu), 1,950 m., 17 Aug. 1949, *Ludlow, Sherriff & Hicks 21031.*

S.E. TIBET : Kulu Phu Chu, near Paka, 3,600 m., 26 July 1938, *Ludlow, Sherriff & Taylor 5942.* Nambu La, 3,000–3,600 m., 13 Aug. 1924, *Kingdon-Ward 6084* (Herb. Kew) ; 3,750 m., 27 Sept. 1947, *Ludlow, Sherriff & Elliot 15795.* Tongkyuk, Pome Snow Range, 3,600–3,900 m., 1 Aug. 1935, *Kingdon-Ward 12108.*

A. hookeri was first described from Pedurutalagala in Ceylon. Its occurrence in that island is one of the puzzles of plant-geography, since its main area of distribution comes no nearer Ceylon than the Khasi Hills of Assam. It extends eastward from the Himalaya to western China ; Airy-Shaw (1931) gives records from Yunnan and Szechwan.

Regel (1875) included *A. hookeri* under *A. wallichii.*

13. **Allium fasciculatum** Rendle in Journ. of Bot. xliv : 42 (1906).—Stearn in Herbertia xii : 83 (1947).

Allium gageanum W. W. Sm. apud Sm. & Cave in Rec. Bot. Surv. Ind. iv : 247 (1911).

WESTERN NEPAL : Suli Gad, 3,150 m., 23 June 1952, *Polunin, Sykes & Williams 2294.*

---

[1] **Allium lancifolium** Stearn, nom. nov. (Fig. 10 *b*.)

Allium polyastrum var. *platyphyllum* Diels in Not. R. Bot. Gard. Edinb. v : 300 (1912).

Allium platyphyllum (Diels) Wang & Tang in Bull. Fan Mem. Inst. Biol., Bot. Ser. vii : 296 (1937) ; non *A. platyphyllum* Tidestr. (1916).

Bulb cylindric, elongated, narrow, c. 4–5 mm. in diam., consisting simply of a few membranous sheaths around the lower part of the stem which disintegrate at the base into a few light-brown parallel fibres 10–15 mm. long ; stem 33–50 cm. high, angled, glabrous, clothed for the lower 12–16 cm. with the sheath of the lowermost leaf. *Leaves* 3 or 4, parting from the stem at about the same level or at distances of 1–3 cm. ; lamina of lower two or three leaves narrowly or very narrowly lanceolate, 11–18 cm. long, 2–3 cm. broad, acute at the apex, contracted at the base into a sheathing petiole 1–2·5 cm. long ; uppermost leaf almost linear, 0·6–1 cm. broad. *Spathe* quickly deciduous, about 2 cm. long ; umbel erect, hemispherical, loose, many- (40–50-) flowered, 4–5·5 cm. in diam. ; pedicels 1·5–2·5 cm. long. *Perianth* stellate, " deep magenta " ; tepals spreading or reflexing, narrowly oblong, c. 6 mm. long, 1·5–2 mm. broad, acute. *Stamens* erect ; filaments free, c. 5–5·5 mm. long, subulate from a slightly broadened untoothed base c. 0·5 mm. broad ; anthers after dehiscence c. 1·2 mm. long. *Ovary* obovoid, dark, without conspicuous nectarial pits ; ovules 2 in each loculus ; style c. 2 mm. long.

YUNNAN : Eastern flank of Lichiang Range (27° 25′ N.), 3,000–3,300 m., Sept. 1906, *Forrest 2994* (holotype in Herb. Edinb. ; isotype in Herb. Brit. Mus.). Eastern flank of Tali Range (25° 40′ N.), 3,300–3,600 m., Aug. 1910, *Forrest 6865* (Herb. Kew). Near Talifu, 2,800–3,000 m., Aug. 1914, *Schneider* 2949 (Herb. Kew).

This is a rare or local species briefly characterized by Diels as a variety of *A. polyastrum* and raised to specific rank by Wang and Tang. Unfortunately the name *A. platyphyllum* had already been used by Tidestrom in 1916 for a western American plant now regarded as conspecific with *A. tolmiei* Bak., i.e. *A. tolmiei* var. *platyphyllum* (Tidestr.) Ownbey in Res. Stud. State. Coll. Wash. xviii: 28 (1950).

CENTRAL NEPAL : Taglung (south of Tukucha), Kali Gandaki, 2,850 m., 14 July 1954, *Stainton, Sykes & Williams 1806*. Tukucha, Kali Gandaki, 3,150 m., 22 Aug. 1954, *Stainton, Sykes & Williams 7393*. Pura (Muktinath), 3,600 m., 29 July 1954, *Stainton, Sykes & Williams 2096*. Kimaling (north of Mustang), 4,200 m., 11 Aug. 1954, *Stainton, Sykes & Williams 2374*. Khangsar, 4,350 m., 24 July 1950, *Lowndes 1227*. Managey, 3,150 m., 19 May 1932, *Sharma* E*300*. Manang, 3,900 m., 22 July 1931, *Sharma* E*44*.

SIKKIM : Llonak, 4,500 m., 5 Aug. 1909, *Smith & Cave 2130* (isotype of *A. gageanum* in Herb. Kew). Natu La, 4,800 m., Sept.–Oct. 1909, *Ribu & Rohmoo 2771* (Herb. Kew).

BHUTAN : Ka-po-op, 28 July 1884, *Dungboo 245*. Me La, Cho La valley, 3,750 m., 2 July 1949, *Ludlow, Sherriff & Hicks 20469*.

S.E. TIBET : Shekar Dzong, 4,250 m., 9 Aug. 1922, *Everest Expedition 346* (Herb. Kew). Tingi, Tibetan Plateau, 4 July 1924, *Hingston 216* (Herb. Kew). Khambajong, 16 July 1903, *Younghusband 89* ; Sept. 1903, *Prain*. Phari, July 1879, *Dungboo* (lectotype in Herb. Brit. Mus.). Near Phari, 4,500 m., Sept. 1938, *Gould 1594* (Herb. Kew). Tuna to Khamba, 4,800 m., 9 July 1939, *Gould 2346* (Herb. Kew). Teling, Aug. 1879, *Dungboo*. Lingshi, Phile La, 3,900 m., 23 July 1914, *Cooper 1745*. Gyantse, July–Sept. 1904, *Walton 68* and without n. ; 3,900 m., 27 July 1924, *Ludlow 59* ; 19 Aug. 1935, *Cutting & Vernay 46* (Herb. Kew). Khangme, north of Phari, 3 Aug. 1882, *King's collector*. Tibet, 1882, *King's collector 152*. Nangtse, 20 miles west of Lhasa, 3,750 m., 27 July 1943, *Ludlow & Sherriff 9803*. Hills north of Lhasa, 4,200 m., 25 June 1943, *Ludlow & Sherriff 9703*. Reting, 60 miles north of Lhasa, 4,500 m., 24 July 1942, *Ludlow & Sherriff 8879*; 4,050 m., 18 July 1944, *Ludlow & Sherriff 11027*. Lhasa area, 3,750 m., July 1939, *Richardson 252, 252a*. Pangkar, Shoga Chu, 3,900 m., 6 Sept. 1947, *Ludlow, Sherriff & Elliot 15684*. Sumbatse, Kyimdong Chu, 3,750 m., 16 Sept. 1936, *Ludlow & Sherriff 2606*. Gyamda Valley, 3,900 m., 23 Aug. 1935, *Kingdon-Ward 12252*. Upper Yigrong Valley, 3,600 m., 16 Aug. 1935, *Kingdon-Ward 12219*. Dzala, Pasum Chu, 3,750 m., 3 July 1947, *Ludlow, Sherriff & Elliot 14066*. Tongkyuk, 2,700 m., 30 July 1935, *Kingdon-Ward 12092*. Gyala, Tsangpo Valley, 2,800 m., 9 July 1938, *Ludlow, Sherriff & Taylor 7548* ; 21 July 1938, *Ludlow, Sherriff & Taylor 5340*.

There is also a record from further east in Tibet : Yindru, Tsangpo-Salween Divide, 3,600 m., 8 Aug. 1933, *Kingdon-Ward 10709*.

A. fasciculatum is a species of the Tibetan plateau which extends into the dry upper regions of Bhutan, Sikkim and Nepal. The swollen roots presumably serve as storage organs compensating for the reduction of the bulb.

14. **Allium atrosanguineum** Schrenk in Bull. Sci. Acad. Imp. Sci. St.-Pétersb. x : 355 (Jul. 1842) ; Enum. Alt. Pl. Nov. : 9 (1842–43).—Ledeb., Fl. Ross. iv : 168 (1852).—Regel, Allior. Monogr. : 83 (1875).

Allium monadelphum Turcz. in Bull. Soc. Imp. Nat. Mosc. xi : 102 (1838), *nom. nud.*
Allium atrosanguineum Kar. & Kir. in Bull. Soc. Imp. Nat. Mosc. xv : 508 (Oct. 1842) ; non *A. atrosanguineum* Schrenk (Jul. 1842).—Kunth, Enum. Pl. iv : 684 (1843).

Allium monadelphum Turcz. ex Kar. & Kir., loc. cit. (Oct. 1842).—Kunth, Enum. Pl. iv: 393 (1843).—Ledeb., loc. cit. (1852).—Turcz. in Bull. Soc. Imp. Nat. Mosc. xxvii, 2: 120 (1854); Fl. Baic.-dahur. ii, 2: 216 (1856).—Regel, op. cit.: 85 (1875); in Act. Hort. Petrop. x: 307 (1887).—Vvedensky in Fl. URSS iv: 189 (1935), transl. in Herbertia xi: 142 (1946).

Allium chalcophengos Airy-Shaw in Not. R. Bot. Gard. Edinb. xvi: 137 (1931).

S.E. TIBET: Nyenchengtang La, N.W. of Lhasa, 4,350 m., 13 June 1943, *Ludlow & Sherriff 9682*. Tulung La, Mönyul, 4,800–5,100 m., 13 June 1935, *Kingdon-Ward 11685*. Lang La, between Kyimdong Dzong and Lilung, 4,650 m., 20 June 1936, *Ludlow & Sherriff 1841*. Lang La, Kyimdong Dzong, 4,800 m., 17 Oct. 1936, *Ludlow & Sherriff 2693*. Lochen La, 3,900 m., 20 Aug. 1935, *Kingdon-Ward 12241*. Lingtsang La, Langong, 4,050–4,200 m., 21 Oct. 1938, *Ludlow, Sherriff & Taylor 6617*. Langong, 4,350 m., 31 May 1938, *Ludlow, Sherriff & Taylor 3930*. Chiniung La, Langong, 4,200 m., 18 Oct. 1938, *Ludlow, Sherriff & Taylor 6613*. Nambu La, 4,500 m., 14 June 1947, *Ludlow, Sherriff & Elliot 13889*; 13 July 1947, *Ludlow, Sherriff & Elliot 15436*. Nyima La, 4,800 m., 4 July 1938, *Ludlow, Sherriff & Taylor 5118*.

The taxonomy of this species presents some difficulty, and its nomenclature also requires clarification. Between 1831 and 1833 Turczaninow collected, in the Dauria region of eastern Siberia, an Allium remarkable for its connate stamens, which he named *A. monadelphum*. He quickly distributed specimens to friends and correspondents under this name, but did not himself publish a description until 1854. Meanwhile the first valid publication of the name *A. monadelphum* was made almost inadvertently in 1842 by Karelin and Kirilow who contrasted with Turczaninow's species their own *A. atrosanguineum* from Dzungaria. In the same year Schrenk had also published an *A. atrosanguineum* which he had collected on Mount Dschabyk in Dzungaria. All these plants are now regarded as conspecific. In 1875 Regel kept *A. monadelphum* and *A. atrosanguineum*, together with *A. fedschenkoanum* Regel and *A. kaufmanni* Regel, as separate species, but by 1887 the difficulty of classifying abundant material, gathered meantime by Russian and German explorers of Siberia, compelled him to regard them all as variants of one polymorphic species spread over southern Siberia, Mongolia and southern Turkistan and penetrating into Tibet. For this he adopted the name *A. monadelphum*, under which he distinguished eight intergrading varieties, among them a var. *tibeticum*, with stem 3–6 cm. high, collected in north-eastern Tibet and Kansu by Przewalski. Material of the last taxon gathered further south, in Szechwan, Yunnan and south-eastern Tibet by Pratt, Wilson and Forrest, was described by Airy-Shaw in 1931 as *A. chalcophengos*. It is evident, as Vvedensky emphasized in 1935, that these plants constitute a very complex and polymorphic group difficult to analyse into separate units and hence more conveniently treated as one species. For this Vvedensky, like Regel, adopted the name *A. monadelphum*.

The independent publication of the name *A. atrosanguineum* by Schrenk and of *A. atrosanguineum* and *A. monadelphum* by Karelin and Kirilow, as also of *A. pseudocepa* Schrenk and *A. galanthum* Kar. & Kir., *Carex songarica* Schrenk and *C. songorica* Kar. & Kir., in works dated " 1842 " has created a bibliographical problem not easy to solve.

The instalment of A. Schrenk's " Novae plantarum species . . . in Songaria lectae " containing his descriptions of *A. oreoprasum*, *A. atrosanguineum*, *A. pseudocepa* and *Carex songarica* appeared in Bull. Sci. Acad. Imp. Sci. St.-Pétersb. x, n. 23, " Emis le 18 juillet 1842 ", the previous number being " Emis le 5 juillet 1842 " ; in the absence of evidence to the contrary, July 1842 can be accepted as its month of issue.

The instalment of Karelin and Kirilow's " Enumeratio plantarum in desertis Songoriae orientalis ", containing descriptions of their *A. atrosanguineum*, *A. galanthum*, *A. polyphyllum*, etc., appeared in Bull. Soc. Imp. Nat. Mosc. xv, n. 3, which is simply dated " 1842 ". The Paris Académie des Sciences received the previous part (xv, n. 2) between 12 and 19 September 1842 and evidently then applied to Moscow for missing earlier parts of the *Bulletin*, i.e. xiv, n. 4 (1841), and xv, n. 1 (1842), which were received in Paris by 31 October 1842 (cf. Compt. Rend. Acad. Sci. Par. xv : 602, 859). The Linnean Society of London received the *Bulletin* xv, n. 2, on 2 October 1842. It is a fair assumption that had the *Bulletin* xv, n. 3, been published when these were dispatched to Paris and London, i.e. in September and early October 1842, it would have been sent at the same time. Actually, however, the Paris Académie did not receive this part until the week of 23–30 January 1843 (cf. Compt. Rend. Acad. Sci. Par. xvi : 280), while the Regensburg Botanische Gesellschaft received it between 25 January and 4 February 1843 (cf. Flora xxvi, 1 : 84).

However, according to the report of the meeting of the Société Impériale des Naturalistes de Moscou held on 15 October 1842, " Mr. le second Secrétaire, le Docteur Renard, présente le No. 3 du Bulletin de la Société lequel paraît sous sa rédaction " (Bull. Soc. Imp. Nat. Mosc. xv, n. 4 : 896). Presumably it was made available to members of the Société in Russia about this time ; hence October 1842 may be taken as its month of publication. The Linnean Society acquired it much later.

On the above evidence the name *A. atrosanguineum* Schrenk is the first validly published name available for the collective species commonly known as *A. monadelphum* and Regel's epithet *tibeticum* the first one available in a varietal sense for the population representing this species in eastern Tibet and western China.

In south-eastern Tibet the colour of the flowers in a living state is a glossy light red-purple described as " pale damson " (*L., S. & T. 5118*), " light maroon " (*L., S. & E. 15436*), " pale glistening mulberry colour " (*L., S. & E. 13889*), " shiny purplish mauve " (*L., S. & T. 3930*) and " deep mauve " (*L. & S. 1841*).

15. **Allium macranthum** Bak. in Journ. of Bot. xii : 293 (1874) ; in Curt., Bot. Mag. cx : t. 6789 (1884).—Regel, Allior. Monogr. : 182 (1875).—Hook. f., Fl. Brit. Ind. vi : 345 (1892).—Rendle in Journ. of Bot. xliv : 44 (1906).—Sm. & Cave in Rec. Bot. Surv. Ind. iv : 248 (1911).—Stearn in Herbertia xii : 82 (1947).

Allium oviflorum Regel in Gartenflora xxxii : 321, t. 1134 (1883) ; in Act. Hort. Petrop. viii : 658 (1883).

Allium simethis Lév. & Giraud. in Fedde, Repert. Sp. Nov. xii : 288 (1913).

SIKKIM : Lachen, 3,900 m., *Hooker 9* (holotype in Herb. Kew). Above Tangu, 4,200 m., 13 Aug. 1909, *Smith & Cave 2378* (Herb. Kew).

BHUTAN : Chojo Dzong, Upper Pho Chu, 4,350 m., 3 July 1949, *Ludlow, Sherriff & Hicks 16715*. Tranza, Upper Pho Chu, 3,900 m., 17 Sept. 1949, *Ludlow, Sherriff & Hicks 17258*. Ha to Chile La, 2,700–3,600 m., 22 July 1938, *Gould 1257*A (Herb. Kew).

S.E. TIBET : Sham Chen, July 1879, *Dungboo*. Chumolari, 4,800 m., *Rohmoo Lepcha 453* (Herb. Kew). West of Yatung, 3,000 m., 3 Aug. 1936, *Chapman 325* (Herb. Kew).

First described from near Lachen in upper Sikkim, *A. macranthum* is now known to extend eastward into Yunnan and Shensi. It is evidently uncommon over its wide range ; otherwise so handsome and conspicuous a plant would have been more frequently collected. Its large drooping rose-purple flowers recall those of the North American *A. cernuum* Roth, and it also parallels various North American species in the development of swellings or crests upon the top of the ovary.

16. **Allium rhabdotum** Stearn, sp. nov. (Fig. 10 *c* ; Plate 11.)

Herba odore alliaceo etiam in sicco valde foetens ; bulbus cylindricus, elongatus, c. 1·5–2 cm. diam., rhizomati crasso descendenti insidens, tunicis interioribus membranaceis rubris, exterioribus brunneis in lacinias vel fibras plus minusve parallelas fissis ; caulis validus, 80–125 cm. altus, c. 10 mm. diam., fistulosus (sed non inflatus), laevis, glaber, ad $\frac{1}{3}$ usque $\frac{1}{2}$ longitudinis suae vaginis foliorum vestitus. *Folia* 2–4, caulina ; vagina laevis ; lamina ascendens, fistulosa, 18–40 cm. longa, 3–7 mm. lata (in sicco). *Spatha* cito caduca, ut videtur univalis, ad 2 cm. longa ; umbella globosa, densa, multiflora, 3–4 cm. diam. ; pedicelli inaequales, ad 1·5 cm. longi. *Perianthium* cupulare ; tepala erecta, anguste obovata, apice rotundata, alba (in sicco ochroleuca), nervo medio pullo percursa, exteriora c. 9 mm. longa et 4·5–5 mm. lata, interiora c. 10 mm. longa et 4–4·5 mm. lata. *Stamina* exserta ; filamenta simplicia, subulato-filiformia, alba, c. 12 mm. longa, libera ; antherae c. 1 mm. longae. *Ovarium* laeve ; ovula in quoque loculo 2 ; stylus subulatus, ad 5·5 mm. longus. *Capsula* c. 5 mm. longa, tepalis persistentibus erectis vestita ; valvae late ovatae, apice rotundatae, c. 4 mm. latae ; semina compressa, nigra, c. 3·5–4 mm. longa, rugosa.

BHUTAN : Phajudin Timpu, 3,900 m., 5 Aug. 1914, *Cooper 3245*. Joedownchi, Tongsa, 3,600 m., 18 Sept. 1915, *Cooper 4816*. Kantanang, Tsampa, 4,200 m., 10 June 1949, *Ludlow, Sherriff & Hicks 19092*. Shingbe (Me La), 3,900 m., 22 Aug. 1949, *Ludlow, Sherriff & Hicks 21059*. Between Me La and Cho La (approximately 28° N., 91° 45′ E.), 3,750 m., 27 Aug. 1949, *Ludlow, Sherriff & Hicks 21442* (holotype in Herb. Brit. Mus.).

By its tall growth and markedly fistulose leaves clothing the stout stem for a third to half of its length, *A. rhabdotum* stands apart from other Alliums of the Eastern Himalaya and approaches *A. fistulosum* L., the well-known cultivated Welsh Onion or Ts'ung (cf. Prokhanov, 1930 ; Stearn, 1943 ; Helm, 1956), which is the most important garlic crop of the Far East, and its wild counterpart *A. altaicum* Pall. of Siberia, Dzungaria and Mongolia, although distinct from both in its rounded tepals and shorter filaments. The specific epithet, from ‘*ραβδωτος* (striped), refers to the conspicuous dark median nerve of the tepals and has been suggested by Balfour's earlier application of it to *Rhododendron rhabdotum*, likewise a species of

Bhutan. *A. rhabdotum* is recorded as growing in running water, in gravel by a stream edge, on open grassy hillsides and among dwarf rhododendrons and juniper. At Kantanang the inhabitants eat the parts above ground, often after cutting up and drying them.

17. **Allium hypsistum** Stearn, sp. nov. (Plate 12.)

Herba bulbis confertim aggregatis caespites formans ; bulbus cylindricus, elongatus, angustus, c. 1 cm. diam., rhizomati brevi insidens, tunicis exterioribus c. 8–9·5 cm. longis in fibras reticulatas brunneas dissolutis ; caulis gracilis, teres, 19–21 cm. altus, c. 2 mm. diam., glaber. *Folia* 4–6, subbasalia, scapo paulo breviora, linearia, plana, 10–16 cm. longa, 2–5 mm. lata, apice obtusa. *Spatha* persistens, bi- vel tri-partita vel raro indivisa, rubra, c. 8–10 mm. longa, valvis ovatis acutis umbella vix brevioribus ; umbella densa, hemisphaerica, multiflora (floribus 12–40), c. 1·5–2 [–3] cm. diam. ; pedicelli c. 2 [–6] mm. longi, perianthio multo breviores, basi nudi. *Perianthium* campanulatum ; tepala erecta, apice acuta vel obtusa leviter dentata, rosea nervo medio rubro percursa, exteriora elliptica c. 6·5 [–8·5] mm. longa et 2·8–3 [–3·5] mm. lata, interiora anguste oblonga c. 7 [–10] mm. longa et 2·4–2·6 [–3] mm. lata. *Stamina* inclusa, c. 4·5–5 [–6·5] mm. longa ; filamenta simplicia, subulata, alba, inferne gradatim dilatata et basi inter se in annulum vix 0·5 mm. altum connata ; antherae flavae, c. 1 mm. longae. *Ovarium* laeve, ellipsoideum ; ovula in quoque loculo 2 ; stylus subulatus, c. 2·5 mm. longus, apice indivisus.

CENTRAL NEPAL : About 4 miles S.W. of Saldanggaon, 29° 18′ N., 83° 05′ E., c. 5,500 m., 26 June 1952, *Polunin, Sykes & Williams 8* (holotype in Herb. Brit. Mus.). Without precise locality, 1956, *Snellgrove.*

A. hypsistum inhabits the high arid region of Central Nepal north of the main Himalayan range and adjoining the Tibetan plateau, which has similar alpine steppe vegetation ; probably, like *Ceratostigma ulicinum* and *Milula spicata*, it grows both in northern Nepal and southern Tibet. Its reticulately fibrous bulb-coats, 4 to 6 narrow linear leaves, very short pedicels, slightly dentate tepals and simple included filaments together distinguish it from other Himalayan species. Its affinities seem to be with species of Central Asia. According to Vvedensky's key to the *Allium* species of the U.S.S.R. (cf. Vvedensky, 1946) and N. B. Pavlov's key to those of Kazakhstan in Fl. Kazakhstana ii : 134–142 (1958) it comes nearest to *A. oreoprasoides* Vved. in Trans. Sci. Soc. Turkestan ii : 29, t. 1 (1925), a species of the Kara Tau mountains of Kazakhstan. This, however, has pedicels two or three times as long as the flowers, spathe-valves with a beak almost as long as the basal part, subglobose flowers and filaments slightly longer than the tepals, which also differ in shape from those of *A. hypsistum.* The epithet *hypsistum* (‘*υψιστος*, “ dwelling in high places ”) refers to the high altitude at which it was collected by Oleg Polunin, who found it growing in scree along stream sides about four miles from Saldanggaon, one of the highest villages in the world. His specimens have the flowers just opening. A more mature umbel and a single leaf evidently belonging to the same species were collected in the same area but without precise locality by David L. Snellgrove, author of *Buddhist Himālaya* (1957) ; measurements given above in brackets have been taken from this specimen.

18. **Allium** sp.

CENTRAL NEPAL : Samargaon, north of Tukucha, 28° 57′ N., 83° 49′ E., 4,500 m., 16 Aug. 1954, *Stainton, Sykes & Williams 7279.*

The above material collected by J. D. A. Stainton in the arid zone of Central Nepal represents a species distinct from any hitherto recorded from the Himalaya, but is in too young a state for naming ; the spathes are just beginning to burst, the flowers being immature. The bulb is ovoid, nearly 2 cm. in diameter, with membranous coats. The stem, which rises to about 55 cm., is clothed for about half its height by the glabrous membranous sheaths of five leaves, the laminas of which are linear and flat, the largest nearly 40 cm. long, 2 cm. broad. The shortly two-beaked spathe is 2·5–3·5 cm. long and evidently encloses a loose many-flowered umbel, with some pedicels at least 1·8 cm. long. The only flower almost mature has blunt tepals about 4·5 mm. long and 2·5 mm. broad ; all six filaments are free, subulate, entire and shorter than the tepals ; the anthers are pale, the ovary smooth, the style 3 mm. long. In habit of growth this species resembles some members of the *Alliotypus* (*Porrum*) group but its floral structure is that of the *Molium* group and it may be akin to *A. loratum* Bak., which, however, has all the leaves parting from the base of the stem. It is not included in the key on pp. 169–171.

MILULA Prain

Milula spicata Prain in Sci. Mem. Med. Offic. Army Ind. ix : 57, t. 1 (1895) ; in Ann. R. Bot. Gard. Calcutta v : 165, t. 200 (1896).

CENTRAL NEPAL : Namdo, north of Mustang, 4,350 m., 8 Aug. 1954, *Stainton, Sykes & Williams 2272.*

S.E. TIBET : Chumbi, near Do-tha, Aug. 1878, *Dungboo* (isotype in Herb. Kew). Phari to Tuna, 4,200–4,500 m., 6 Aug. 1936, *Chapman 403* (Herb. Kew). Gyantse, July–Sept. 1904, *Walton 140* (Herb. Kew) and without n. ; 3,900 m., 26 Aug. 1924, *Ludlow 104.* Saugang, 4,100 m., 11 Aug. 1936, *Chapman 710* (Herb. Kew). Netang, near Lhasa, 3,750 m., 8 Apr. 1943, *Ludlow & Sherriff 9474.* Hills above Drepung, Lhasa, 3,600–4,200 m., 3 Sept. 1943, *Ludlow & Sherriff 9913.* Near Reting, north of Lhasa, 3,600 m., 3 Aug. 1942, *Ludlow & Sherriff 8998.* Kyichu valley, 14 miles east of Lhasa, Sept. 1939, *Richardson 365.* Vicinity of Lhasa, 1946–50, *Aufschnaiter.* Lhasa area, 3,450 m., 16 Sept. 1904, *Waddell* (Herb. Kew) ; 3,900 m., July 1939, *Richardson 295.* Dorjetra, Tsangpo Valley, 3,450 m., 1 May 1938, *Ludlow, Sherriff & Taylor 4107.* Gyamda, 3,300 m., 25 Aug. 1935, *Kingdon-Ward 12256.* Lang La, Kongbo, 3,750 m., 17 Oct. 1947, *Ludlow, Sherriff & Elliot 13328.* Tsela Dzong, left bank of Nyang Chu, 3,000 m., 4 Sept. 1938, *Ludlow, Sherriff & Taylor 6218.*

When Prain described this remarkable plant in 1895 he noted that " an overwhelming majority of characters indicate its tribal position to be among the *Allieae*, (tribe xii of *Liliaceae* in Bentham and Hooker's *Genera Plantarum*) " and that its facies is " so completely that of an *Allium* that at first sight one feels inclined, in spite of its spicate inflorescence and its solitary bract, to treat it as the type of a somewhat aberrant section in that comprehensive genus ". It would indeed be an Allium but for its spiciform inflorescence and gamophyllous perianth, and Prain emphasized this resemblance and divergence by coining the anagram *Milula* from *Allium*. He also founded a new subtribe *Miluleae* of *Allieae* to accommodate his new genus, and this was subsequently treated as a tribe *Miluleae*, next to *Allieae*, by K. Krause in Engler & Prantl, Nat. Pflanzenfam., ed. 2, xv, a : 329 (1930). Prain pointed out that the tribe *Scilleae* of *Liliaceae*, with which *Milula* agrees in the single character of a spicate inflorescence but not in facies, has no involving bract. Nevertheless Hutchinson (Fam. Flow. Pl. ii : 100, 130 (1934)), reclassifying the *Liliaceae* and *Amaryllidaceae* on the basis of inflorescence characters, retained *Miluleae* in *Liliaceae* while transferring *Allieae* to *Amaryllidaceae*. He regarded *Milula* as " probably an advanced type of tribe *Scilleae* ". In view of this divergence of opinion, Mr. J. E. Dandy requested Ludlow, Sherriff and Taylor, when on their 1938 expedition, to search specially for *Milula* and to note whether it gave out the garlic odour characteristic of *Allium*. Their resulting observations leave no doubt as to the affinity of *Milula* with *Allium* : " roots smelling faintly of *Allium* when bruised . . . eaten by natives and tasting also slightly of *Allium* " (*L., S. & T. 4107*) ; " slight smell of onion " (*L., S. & T. 6218*). Ludlow and Sherriff (n. *9913*) in 1943 noted " smells of onion ".

The umbel in *Allium* and its allies is shown by ontogenetic studies to result from a contraction of cymes to a single level accompanied by expansion of the lowermost bract or by union of bracts to form a spathe enclosing the inflorescence before anthesis. This special type of spathaceous bract characterizes the *Amaryllidaceae* in Hutchinson's sense but not the *Liliaceae* proper, and if *Allium* be transferred to *Amaryllidaceae* (as I think it should be) then *Milula* must surely accompany it.

There is nothing new in thus emphasizing this character of the spathe. Linnaeus in his *Ordines Naturales* appended to the sixth edition of his *Genera Plantarum* (1764), and in his posthumous *Praelectiones in Ordines Naturales Plantarum* (1792), put *Allium* alongside *Haemanthus, Amaryllis, Pancratium, Narcissus, Galanthus, Leucojum* and *Crinum* in his order *Spathaceae*, which he distinguished from his order *Coronariae* (containing *Lilium, Scilla*, etc.) by its spathe : " Allia omnia habent florem inferum ; non autem hinc separanda esse, iterum docet Spatha, et dantur Species, quae habent florem magnitudine Narcissi " (Praelect. : 275).

Although commonly dwarf, *M. spicata* may attain a height of more than a metre in fruit under very favourable conditions. It is essentially a species of the Tibetan plateau, extending southward into the dry Chumbi Valley, where it was first collected, and into the dry zone of Nepal.

SPECIAL LITERATURE

AIRY-SHAW, H. K. (1931). *Allia* praesertim Sinensia nova vel minus cognita. *Not. R. Bot. Gard. Edinb.* xvi : 135–147.

BAKER, J. G. (1874). On the Alliums of India, China, and Japan. *Journ. of Bot.* xii : 289–295.

BURRARD, S. G., & HAYDEN, H. H. (1907–08). *A Sketch of the Geography and Geology of the Himalayan Mountains and Tibet.* Calcutta.

CHATTERJEE, D. (1940). Studies on the endemic flora of India and Burma. *Journ. R. As. Soc. Bengal*, Sci. v : 19–67.

HELM, J. (1956). Die zu Wurz- und Speisezwecken kultivierten Arten der Gattung *Allium* L. *Die Kulturpflanze* iv : 130–180.

Hooker, J. D. (1892). *The Flora of British India* vi : 337–345. London.

—— (1904). *A Sketch of the Flora of British India.* London.

—— (1947). The Alliums of British India. Revised and supplemented by W. T. Stearn. *Herbertia* xii : 73–84, 174.

Kingdon-Ward, F. (1935). A sketch of the geography and botany of Tibet, being materials for a flora of that country. *Journ. Linn. Soc. Lond.*, Bot. l : 239–265.

—— (1936). A sketch of the vegetation and geography of Tibet. *Proc. Linn. Soc. Lond.* cxlviii : 133–160.

—— (1942). An outline of the vegetation and flora of Tibet. *R. Bot. Gard. Calcutta, 150th Anniv. Vol.* : 99–103.

Mann, L. K. (1959). The Allium inflorescence : some species of the section Molium. *Amer. Journ. Bot.* xlvi : 730–739.

Mann, L. K., & Stearn, W. T. (ined.). Rakkyo or ch'iao tou (*Allium chinense* G. Don, syn. *A. bakeri* Regel), a little-known vegetable crop. *Econ. Bot.* (ined.).

Mason, K. (1955). *Abode of Snow : a History of Himalayan Exploration and Mountaineering.* London.

Prain, D. (1895). On *Milula*, a new genus of Liliaceae from the Eastern Himalaya. *Sci. Mem. Med. Offic. Army Ind.* ix : 25–27.

Prokhanov, Y. (1930). A contribution to the knowledge of the cultivated Alliums of China and Japan. *Bull. Appl. Bot. Leningrad* xxiv : 123–188.

Regel, E. (1875). Alliorum adhuc cognitorum monographia. (*Act. Hort. Petrop.* iii.)

—— (1887). Allii species Asiae centralis. *Act. Hort. Petrop.* x : 279–394.

Schweinfurth, U. (1957). Die horizontale und vertikale Verbreitung der Vegetation im Himalaya. *Bonner Geograph. Abhandl.* xx : i–xii, 1–373.

Stearn, W. T. (1943). The Welsh Onion and the Ever-ready Onion. *Gard. Chron.*, Ser. 3, cxiv : 86–88.

—— (1946). The floristic regions of the U.S.S.R. with reference to the genus Allium. *Herbertia* xi : 45–63.

—— (1946). Nomenclature and synonymy of *Allium odorum* and *A. tuberosum*. *Tom. cit.* : 226–245.

—— (1947). See Hooker, J. D. (1947).

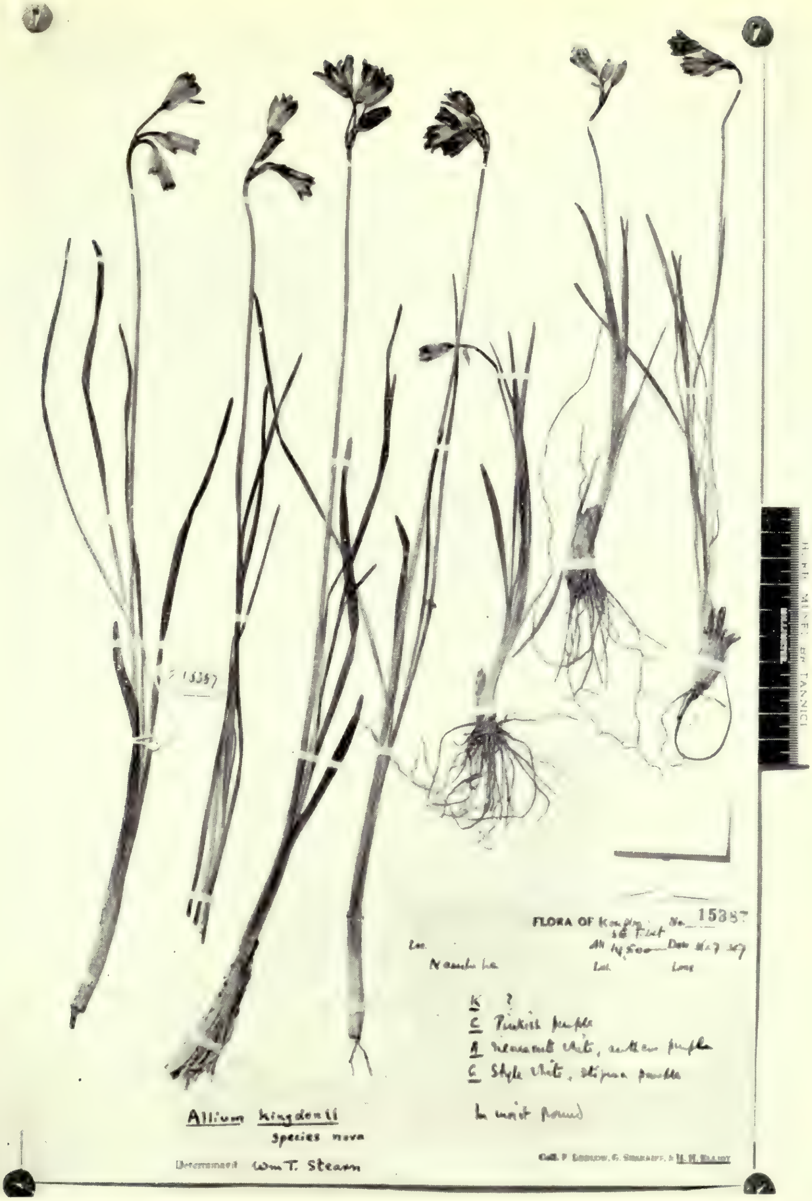
Vvedensky, A. I. (1946). The genus *Allium* in the USSR. Translated by H. K. Airy-Shaw. *Herbertia* xi : 65–218.

Wendelbo, P. (1957). A study in the *Primula rosea* aggregate. *Univ. Bergen Årbok* 1957, Naturvit. 1.

BRITISH MUSEUM
31 MAY 1960
NATURAL HISTORY

PLATE 9

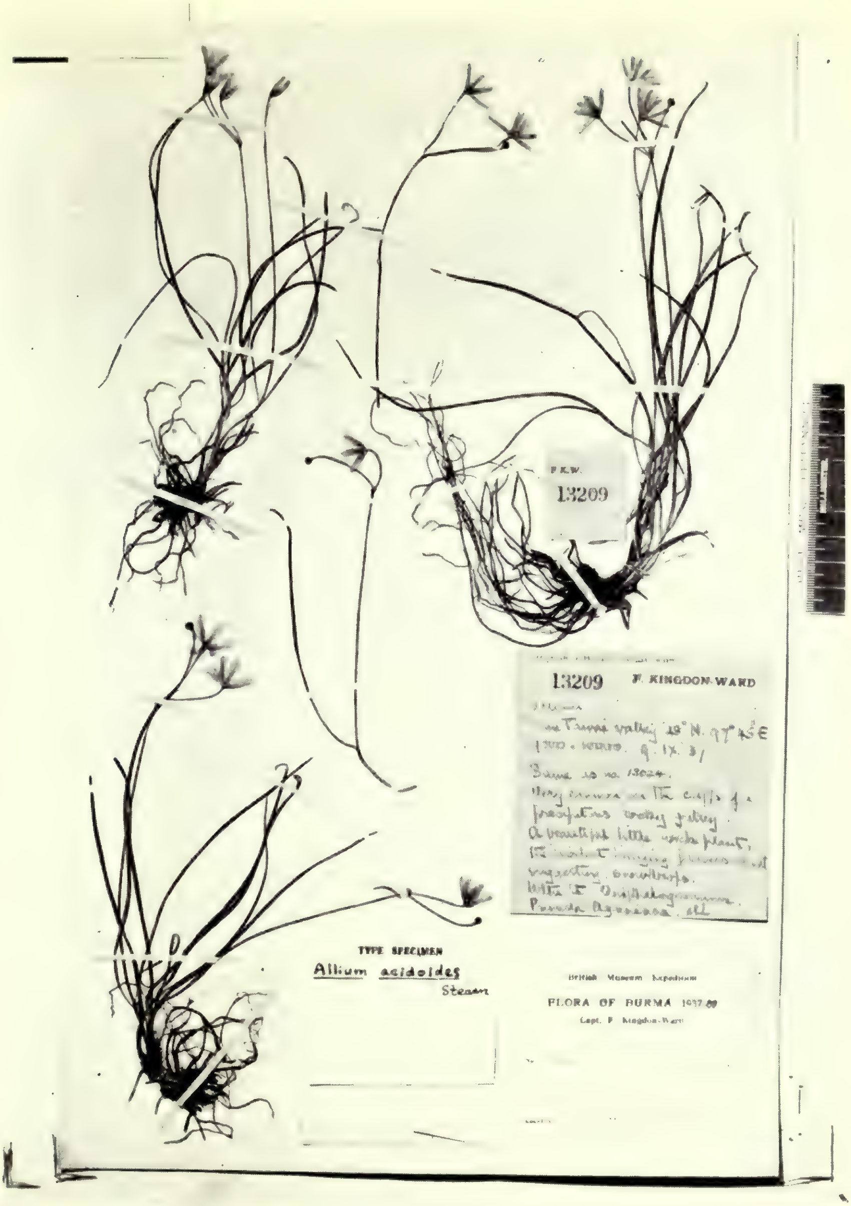
Allium kingdonii Stearn


15387
FLORA OF
No. 15387
Loc.
Lat.
Long.
K ?
C Pinkish purple
G Style white, stigma purple
Allium kingdonii
species nova
Determined Wm T. Stearn

Holotype of *Allium kingdonii* Stearn

PLATE 10

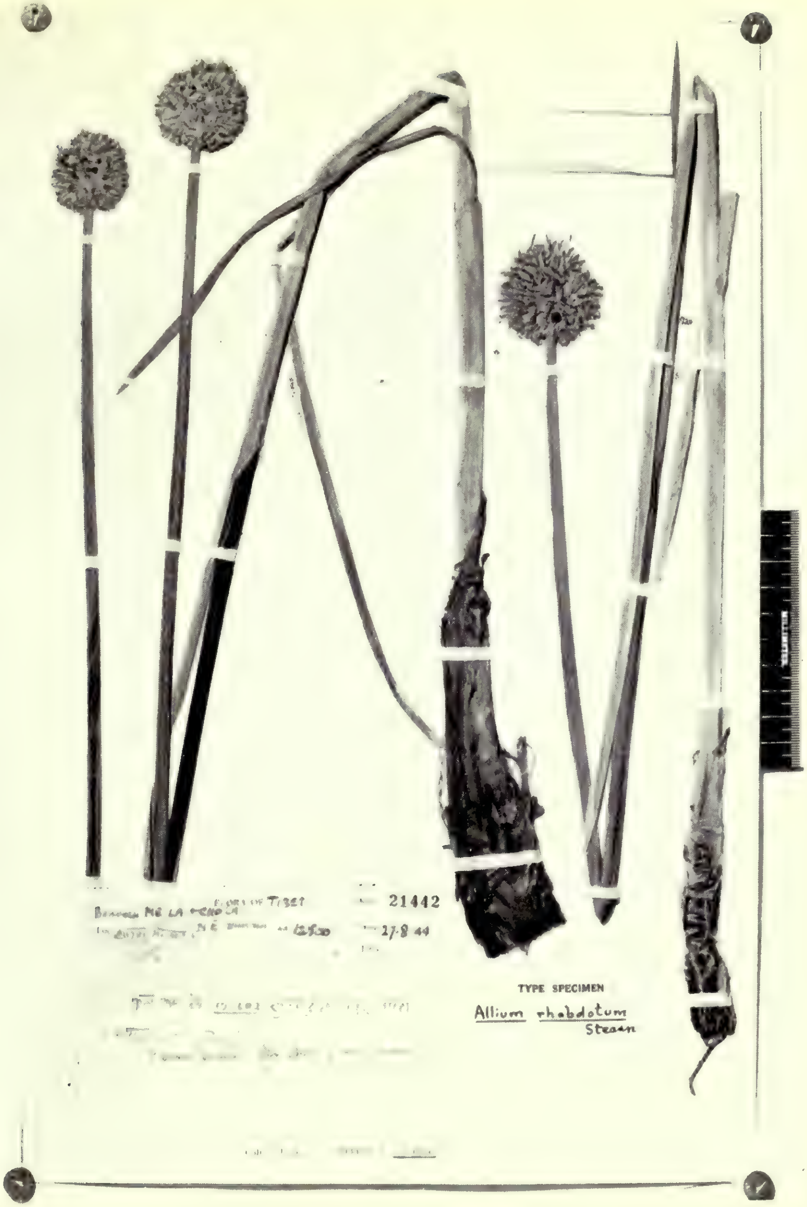
Allium acidoides Stearn


F.K.W.
13209
13209 F. KINGDON-WARD
TYPE SPECIMEN
Allium acidoides
Stearn
British Museum Expedition
FLORA OF BURMA
Capt. F. Kingdon-Ward

Holotype of *Allium acidoides* Stearn

PLATE 11

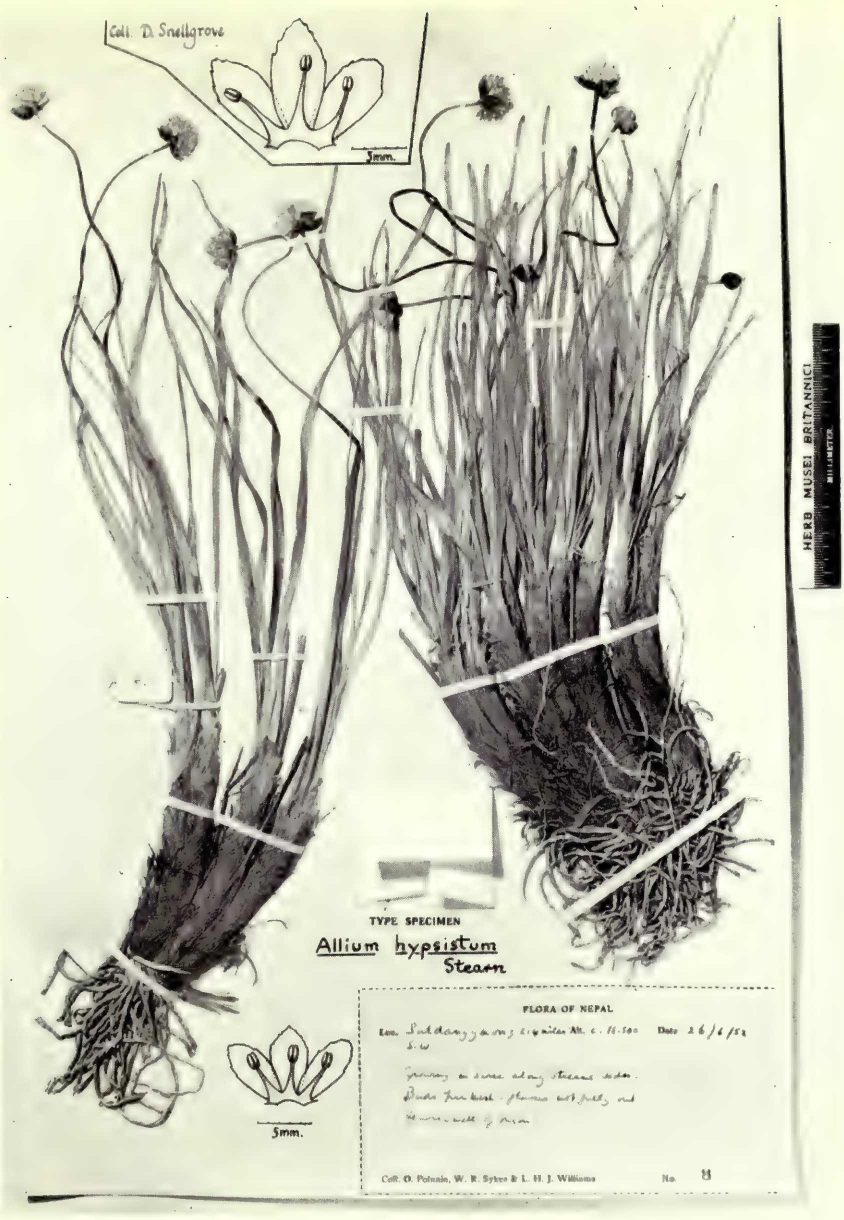
Allium rhabdotum Stearn


FLORA OF TIBET
21442
27.8.44
TYPE SPECIMEN
Allium rhabdotum
Stearn

Holotype of *Allium rhabdotum* Stearn

PLATE 12

Allium hypsistum Stearn


Coll. D. Snellgrove
5mm.
HERB. MUSEI BRITANNICI
MILLIMETER
TYPE SPECIMEN
Allium hypsistum
Stearn
5mm.
FLORA OF NEPAL
Loc.
Date 26/6/52
Coll. O. Polunin, W. R. Sykes & L. H. J. Williams
No. 8

Holotype of *Allium hypsistum* Stearn

THE IDENTITY OF *ISOPYRUM AQUILEGIOIDES* L.

GAVIN DE BEER
AND
WILLIAM T. STEARN

BRITISH MUSEUM
22 JUN 1960
NATURAL HISTORY

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 7
LONDON: 1960

THE IDENTITY OF *ISOPYRUM AQUILEGIOIDES* L.

BY

GAVIN DE BEER

AND

WILLIAM T. STEARN

22 JUN 1960

Pp. 193–202 ; 3 *Text-figures*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 7
LONDON : 1960

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical series.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 7 of the Botany series.

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued June 1960 *Price Six shillings*

THE IDENTITY OF *ISOPYRUM AQUILEGIOIDES* L.

By GAVIN DE BEER & WILLIAM T. STEARN

IN a recent paper[1], Dr. A. Becherer has raised a question of great interest relating to a plant described[2] by Caspar Bauhin in 1620 as *Aquilegia montana parvo flore thalictri folio* " In Helvetiorum alpibus reperitur ". As Drummond and Hutchinson (1920) indicated[3], Linnaeus cited[4] Bauhin's account under his own *Isopyrum aquilegioides* in the *Species Plantarum* (1753) ; at the same time he also cited works by Ray, Morison and Haller, and gave its distribution as "*Habitat in Alpibus* Helveticis, Tridentinis, Apenninis". The Linnaean Herbarium[5], now in London, contains no specimen under the name *Isopyrum aquilegioides* and the identification of the plants concerned therefore constitutes a problem. It is historically interesting to ascertain the identity of Bauhin's plant. It is also nomenclaturally important, as Becherer has indicated, for its relevance to the typification of *Isopyrum aquilegioides* L.

Bauhin's herbarium, now at the Botanisches Institut der Universität Basel, once belonged to Werner de Lachenal who, in 1776, published a paper[6] with an engraving purporting to represent Bauhin's specimen, then already 150 years old (Fig. 1). In 1817, Augustin Pyramus De Candolle had evidently failed[7] to find this *Aquilegia* in Bauhin's herbarium, and in 1843 Hagenbach stated[8] that it was missing. Becherer, however, has found there an incomplete specimen consisting of stem and leaves, but without flowers. Furthermore, Becherer states that Lachenal's figure does not exactly represent the specimen now in Bauhin's herbarium because the arrangement of the leaves is different, although their form is the same, and he considers that these leaves represent *Aquilegia einseleana* F. W. Schultz.

---

[1] Becherer, A., "Bemerkungen zur Gattung Aquilegia", in Ber. Schweiz. Bot. Ges. lxviii: 289–294(1958).

[2] Bauhin, C., *Prodromus Theatri Botanici* : 75 (1620) ; also *Pinax Theatri Botanici* : 144 (1623).

[3] Drummond, J. R., & Hutchinson, J., " A revision of Isopyrum (Ranunculaceae) and its nearer allies ", in Kew Bull. 1920 : 146 (1920).

[4] Linnaeus, C., *Species Plantarum* i : 557 (1753).

[5] Savage, S., *A Catalogue of the Linnaean Herbarium* (1945). To the list of publications on the Linnaean Herbarium given by Stearn, Introd. Sp. Pl.: 111, 123–124 (1957), should be added: Lindberg, H., " Växter kända från Norden i Linnés Herbarium ", in Act. Bot. Fenn. lx (1958).

[6] Lachenal, W. de, *Observationes botanico-medicae* : 12, 13 (1776) ; reprinted in Act. Helvet. viii : 146, t. 5 (1777).

[7] Candolle, A. P. De, *Regni vegetabilis Systema naturale*, i : 337 (1817). Cf. Bull. Herb. Boiss., Sér. 2, iv : 304 (1904).

[8] Hagenbach, C. F., *Florae Basiliensis Supplementum* : 97 (1843).

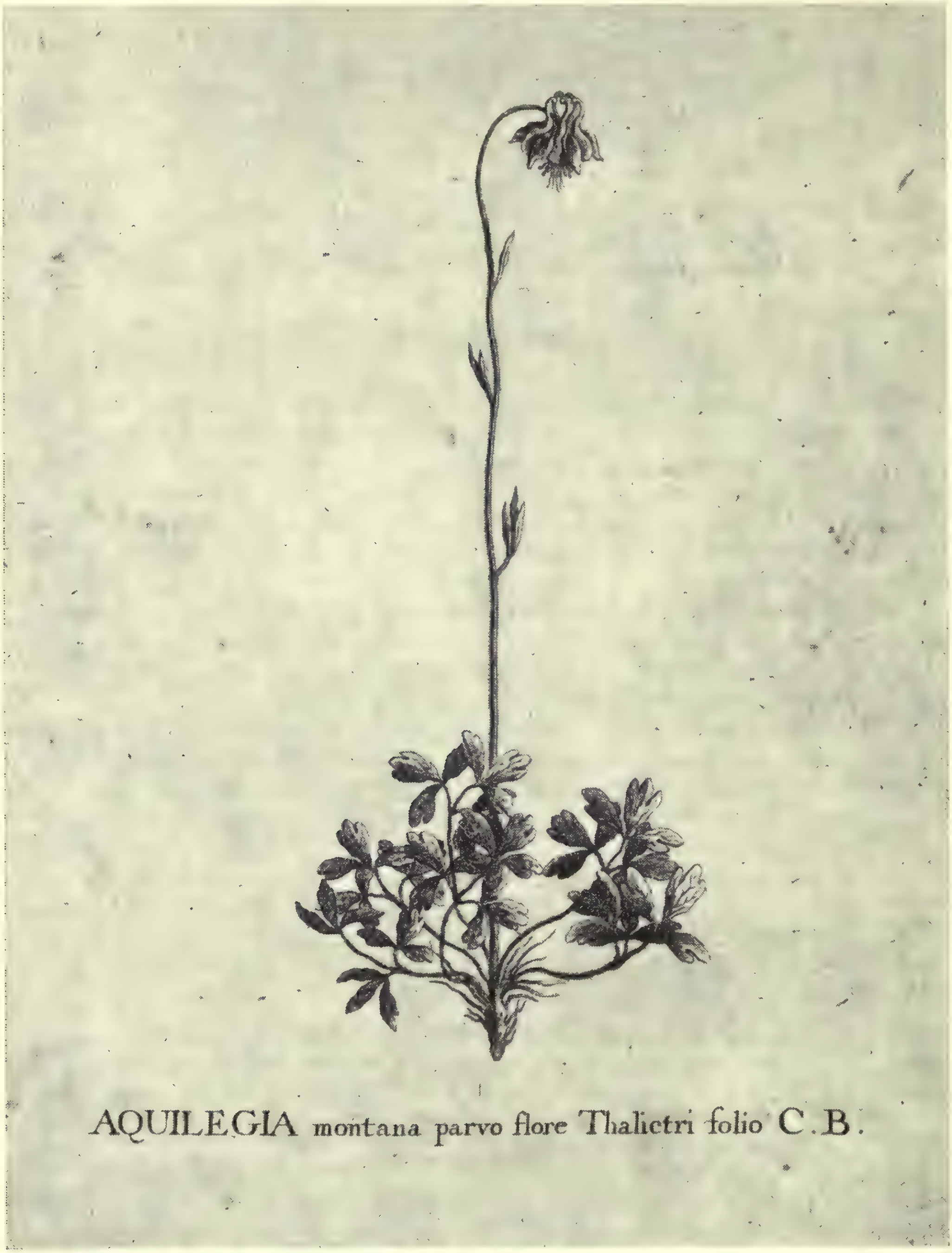

AQUILEGIA montana parvo flore Thalictri folio C.B.

Fig. 1. *Aquilegia montana parvo flore Thalictri folio* C.B. as illustrated in Lachenal, Obs. Bot.-med. (1776).

Lachenal's illustration shows a flower, and this Becherer attributes to *A. vulgaris* L. because of its small size. He therefore considers that Lachenal's figure was a reconstruction based on portions of two different species, i.e. pressed foliage of *A. einseleana* and a fresh flower of *A. vulgaris*, and that the present specimen may be a more recent substitute for the specimen delineated by Lachenal.

It remains to summarize the identification of Bauhin's *Aquilegia* by various authors since Linnaeus who have considered the problem :

Lachenal (1776) *A. viscosa* Gouan ;
A. P. De Candolle (1817) *A. pyrenaica* DC.;
Hagenbach (1843) *A. vulgaris* L. ;
Schott[1] (1853) *A. bauhini* Schott (i.e. *A. einseleana* F. W. Schultz, *fide* Zimmeter[2] (1875)) ;
H. P. Fuchs[3] (1957) *A. einseleana* F. W. Schultz.

No identification was attempted by Haller[4], Gaudin[5], or Drummond and Hutchinson.

Linnaeus himself never visited Switzerland and never saw Bauhin's herbarium. None of the above authors has taken into consideration Linnaeus's use of the herbarium of Joachim Burser (1583–1639) at Uppsala as a source of direct information[6] regarding the species of Caspar Bauhin. Burser was a friend and one-time student of Bauhin, whose publications make many references to "D. Burserus" as a collector of specimens, and Burser's herbarium[7], being arranged in accordance with Bauhin's *Pinax*, proved invaluable to Linnaeus when interpreting Bauhin's work and allocating his names to synonymy. Linnaeus's own notes[8] of his determinations in Burser's herbarium still exist.

---

[1] Schott, H., "Ueber Aquilegien", in Verh. Zool.-bot. Ver. Wien iii: 128 (1853).

[2] Zimmeter, A., *Verwandtschafts-Verhältnisse und geographische Verbreitung der in Europa einheimischen Arten der Gattung Aquilegia*: 53 (1875).

[3] Fuchs, H. P., in Janchen, E., *Catalogus Florae Austriae* i: 180 (1957).

[4] Haller, Albrecht von, *Historia Stirpium indigenarum Helvetiae inchoata* ii : 83 (1768).
? 1190. ISOPYRUM.
Aquilegia montana, flore parvo, Thalictri folio C.B. *Prodr.* p. 75. *Hist. Oxon.* III. p. 458. S. 12. t. 11. f. 5.
Isopyrum stipulis obsoletis LINN. p. 783.
Annon *Aquilegia foliis Thalictri, flosculis minutis, seu albis* MENZEL. *pugill.* t. 8.
In Helvetiorum alpibus C.B. loco non addito.
"Radix exigua : folia Thalictri parva, pallida, virentia : cauliculus tenuis, palma minor, duobus tribusve foliolis brevibus, oblongis, minime divisis. Flos unicus, caeruleus, vulgari Aquilegiae similis, quintuplo minor."

[5] Gaudin, J., *Flora Helvetica* iii : 476 (1828).

[6] De Beer, Gavin, "Joachim Burser et les Alpes de la Suisse", in Les Alpes xxiii : 32–34 (1947) ; also "The Dick Herbarium", in Journ. Linn. Soc. Lond., Bot. lv : 320–332 (1955).
Stearn, W. T., *An Introduction to the Species Plantarum and cognate botanical works of Carl Linnaeus* (C. Linnaeus, Sp. Pl., Ray Soc. facsimile i) : 116–118, 127–128 (1957).

[7] Juel, H. O., "Joachim Burser's Hortus Siccus", in Symb. Bot. Upsal. ii, 1: 43 (1936).
VII (1) 109 "'Aquilegia montana parvo flore Bauh. In horto Dei dicto Galliae Narbonensis.' *Aquilegia vulgaris* L."

[8] Savage, S. (Ed.), *Caroli Linnaei Determinationes in Hortum Siccum Joachimi Burseri*: 21 (1937).
109 *Aquilegia...A. montana parvo flore* Hort. Dei.

The Linnaean protologue of *Isopyrum aquilegioides* in the *Species Plantarum* is as follows :

> 3. ISOPYRUM stipulis obsoletis. *aquilegioides*
> Aquilegia montana, flore parvo, thalictri folio. *Bauh. pin.* 144. *prodr.* 75. *Bauh. hist.* 3. *p.* 484. *Raj. hist.* 707. *Moris. hist.* 3. *p.* 458. *s.* 12. *t.* 11. *f.* 5. *Hall. helv.* 310.
> *Habitat in Alpibus* Helveticis, Tridentinis, Apenninis.

In analysing this, it should be noted that the phrase-name *Isopyrum stipulis obsoletis* is one specifically drafted for the *Species Plantarum*, not taken over from the *Hortus Cliffortianus*, *Hortus Upsaliensis*, or any other earlier Linnaean publication, and, since it simultaneously uses a term *stipulis* of special Linnaean application and calls attention to a character not mentioned in the descriptions of the Bauhins and other pre-Linnaean authors, it must have been based on an illustration or a specimen seen by Linnaeus when writing the *Species Plantarum*. This consideration excludes any specimen in Bauhin's herbarium. The literature cited repeats the information given by Bauhin but also includes a small engraving in Morison's posthumous *Plant. Hist. Univ. Oxon.* iii : sect. 12, t. 1 fig. 5 (1699), labelled *Aquilegia parvo flore Thalictri folio*, which shows a small shoot, without flowers, of uncertain identity but considered by De Candolle to represent *Isopyrum thalictroides* (Fig. 2). Morison's engraving is, however, a copy of one published in Mentzel's *Index Nom. Pl. Univers., Pug. Pl. Rar.*: t. 8 (1682), under the name *Aquilegia fol. thalictri, flosc. minutissimis albis, Apenn. montis*, the text stating that it grew " in Appennini locis petrosis et in Alpibus circa Tridentum ".

Linnaeus's statement " Habitat in Alpibus Helveticis, Tridentinis, Apenninis ", like so many of his statements regarding geographical distribution, can be traced back to Ray's *Historia Plantarum* i : 707 (1686), where Ray, after repeating Bauhin's statement " In Helvetiorum Alpibus reperitur ", adds that Mentzel's *Aquilegia foliis Thalictri, flosculis minutissimis albis* found " in Apennini locis petrosis et in Alpibus circa Tridentum " appears to differ from Bauhin's blue-flowered *Aquilegia montana parvo flore, Thalictri folio* in nothing but the colour of its flowers. From this it was but one step more for Morison's editor Bobart to treat them as identical by using Mentzel's figure to illustrate Bauhin's plant.

It is thus evident that Linnaeus's protologue covers a number of elements :

1. A Swiss plant described by Bauhin ;

2. Plants of the Apennines and the Tridentine Alps recorded by Mentzel, Ray and Morison.

There is also another element, not directly cited by Linnaeus in the *Species Plantarum* but known from his notes to have been consulted by him, namely a specimen (VII (1) 109) in Burser's herbarium labelled "Aquilegia montana parvo flore Bauh." which agrees with Bauhin's description. This specimen is not, however,

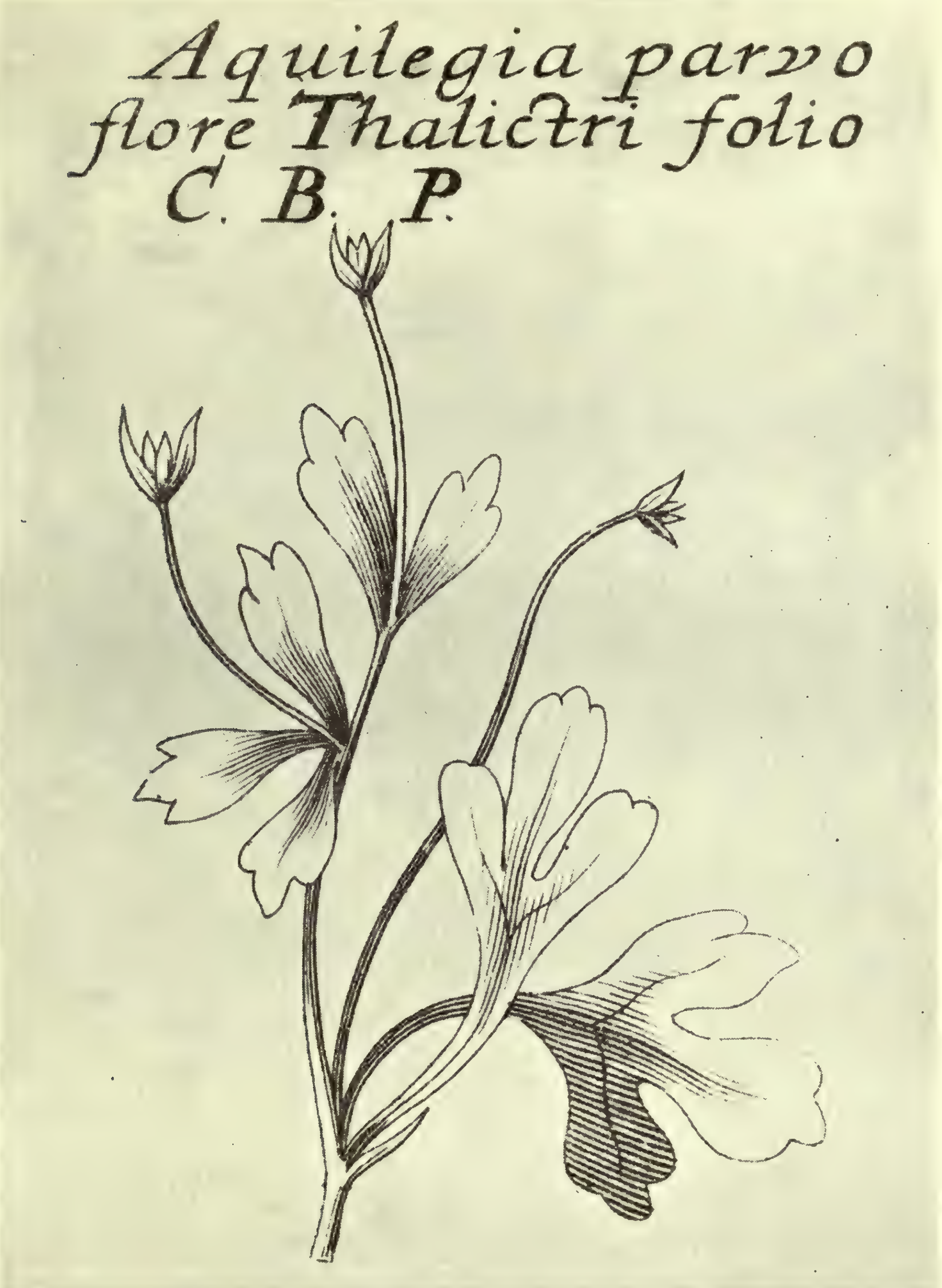

Aquilegia parvo
flore Thalictri folio
C. B. P.

FIG. 2. *Aquilegia parvo flore Thalictri folio* C.B.P. as illustrated in Morison, Pl. Hist. Univ. Oxon. iii: sect. 12, t. 1 fig. 5 (1699); syntype of *Isopyrum aquilegioides* L.

from Switzerland, but from the locality " Horto Dei dicto Galliae Narbonensis ", i.e. from the Hort de Dieu north of Montpellier where Burser botanized. In his notes Linnaeus attributed this to *Aquilegia*. Why he referred Bauhin's plant and Morison's to *Isopyrum* is obscure, because neither in Bauhin's account nor in Morison's figure are any floral details given to place it in *Isopyrum* (defined by Linnaeus as having " *Nectaria*...brevissima...intra corollam posita " and " *Germina* plurima ") rather than in *Aquilegia* (defined by Linnaeus as having the nectarium " inferne productum in tubum longum, attenuatum, pendulum, apice obtuso, incurvo " and " *Germina* quinque "). It may indeed have simply been the dwarf habit. That, despite this, it closely resembled an *Aquilegia* is indicated by his choice of the epithet *aquilegioides*.

From a photograph (Fig. 3) of the Burser specimen at Uppsala, kindly supplied by Dr. Rolf Santesson, it is clear that the plant concerned

(1) is not *A. einseleana* F. W. Schultz because in that species the leaves are too much divided and the flowers and their spurs are too small;

(2) is not *A. alpina* L. because in that species the leaves are too much divided, their segments are too pointed, and the flowers are too big;

(3) is not *Isopyrum thalictroides* L. because in that species the flowers are much too small, have no spur, and the leaves do not come off from the base of the stem.

There seems no reason why it should not be identified as a dwarf form of *Aquilegia vulgaris* L. to which it has already been referred by Juel. Since the choice of lectotype of Linnaeus's *Isopyrum aquilegioides* thus rests between Morison's obscure figure taken from Mentzel and Burser's specimen it is obviously preferable to choose the latter. For nomenclatural purposes *Isopyrum aquilegioides* and the combination *Aquilegia aquilegioides* (L.) H. P. Fuchs based upon it then fall into the synonymy of *Aquilegia vulgaris* L., and the use of *A. aquilegioides* for *A. einseleana* cannot be maintained. At the same time there seems no reason why Hagenbach's view that Bauhin's plant, also, represented a dwarf form of *A. vulgaris* may not be accepted.

The locality " Hortus Dei " or " Hort de Dieu " was not a made garden but a mountainous region visited by many botanists from Montpellier in the 16th, 17th and 18th centuries; originally rich in plants, it became devastated by overgrazing. As pointed out by S. Savage in Proc. Linn. Soc. Lond. cli: 140 (1939), Linnaeus was much interested in this locality, probably on account of its name and the references to it in Burser's herbarium, and he even wrote an *Iter ad Hortum Dei* which has not been published. He never visited the south of France himself but derived his geographical information about the Montpellier region from his correspondent Sauvages (cf. *Lettres inédites de Linné à Boissier de la Croix de Sauvages*: 97, 217 (1860). In the dissertation *Flora Monspeliensis...defert Theoph. Erdm. Nathhorst*: 4 (1756), reprinted with minor alterations in Amoen. Acad. iv: 472 (1759), he describes it as " Hortus Dei (*Lespiron*) 14 Leucis Monspelio, constans valle subrotunda, in excelsissimo loco Montis Calcaris, quam sine labore et periculo nullus adit, hodie paucissimis plantis rarioribus ornatur ".

The locality " Hort de Dieu " is marked on Cassini's *Carte de France*, sheet no. 56 (t. 114), as being about 5 kilometres S.W. of St. André de Valborge and about 65 kilometres N.N.W. of Montpellier, with which accords the statement in P. Joanne,

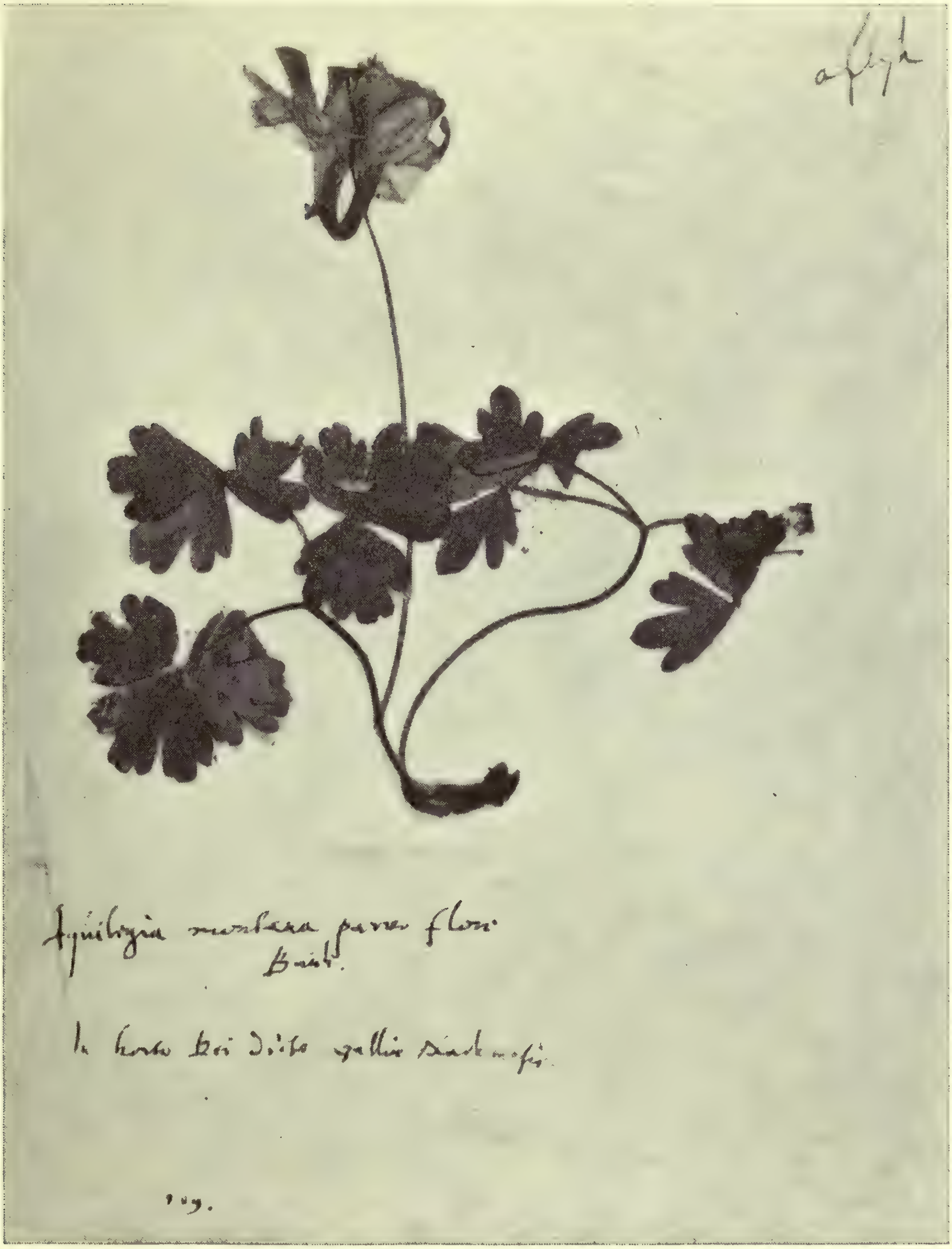

Aquilegia montana parvo flore
Bauh.
In horto Dni Dicto gallis [illegible]
109.

FIG. 3. *Aquilegia montana parvo flore* Bauh. Specimen in Burser's Herbarium, VII (1) 109, Botaniska Museet, Uppsala ; lectotype of *Isopyrum aquilegioides* L.

Dict. Géogr. Admin. France iii : 1893 (1894), that the name was applied to the summit of the Montagne d'Aigoual (1,567 m., 44° 08′ N., 3° 35′ E.) on the border of the departments of Gard and Lozère. The village of Lesperou (Gard), 1,230 m., is close to the Hort de Dieu. This should not be confused with the Mont Hortus or Montagne de l'Hortus nearer Montpellier.

We are very grateful for the co-operation of our colleague Dr. A. Melderis in the identification of Burser's specimen.

BRITISH MUSEUM 22 JUN 1960 NATURAL HISTORY

PRINTED IN GREAT BRITAIN BY
ADLARD AND SON, LIMITED
BARTHOLOMEW PRESS, DORKING

ON THE GEOGRAPHICAL RELATIONSHIPS OF THE ANGIOSPERM FLORA OF NEW GUINEA

RONALD GOOD

BRITISH MUSEUM
22 JUL 1960
NATURAL HISTORY

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 8
LONDON: 1960

ON THE GEOGRAPHICAL RELATIONSHIPS OF THE ANGIOSPERM FLORA OF NEW GUINEA

BRITISH MUSEUM
22 JUL 1960
NATURAL HISTORY

BY

RONALD GOOD

(The University, Hull)

Pp. 203–226; 1 *Text-figure*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 8
LONDON: 1960

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical series.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 8 of the Botany series.

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued July 1960 *Price Ten shillings*

ON THE GEOGRAPHICAL RELATIONSHIPS OF THE ANGIOSPERM FLORA OF NEW GUINEA

By RONALD GOOD

INTRODUCTION

EVER since it was first explored the great island of New Guinea has been generally recognized as a critical part of the world from the point of view of many biological problems, and especially of those relating to the sequence of events by which the gradual population of the world by its plant and animal inhabitants has come about. Yet it has, until comparatively recently, remained little known in comparison with the regions to the north-west, west and south of it. New Guinea is a land of very prominent relief, with much dense forest, and this together with the hostility of many of the native peoples formerly made access to the interior slow and difficult except along some of the rivers, so that for a long time our knowledge of the flora and fauna was scarcely more than representative of the peripheral areas. In the last thirty years, however, three circumstances have combined to hasten the opening up of the country in a remarkable way. In chronological order these are the rapid development of gold-mining some thirty years ago ; the harsh necessities of war ; and the development of air transport. It is particularly the latter which has brought about the latest and most interesting phase of penetration, the exploration since the war of the large and densely populated valleys of the interior highlands. There is, of course, still much to be learned about the plants and animals of New Guinea, and no doubt many important discoveries remain to be made, but we have now, for the first time, a fairly adequate picture of the biology of the island as a whole and can claim with some justification that, although this picture may still need much filling in, its outlines are reasonably clear.

In view of what has been said, and also because New Guinea has never been wholly under the control of a single administration, it is not surprising that the literature of the flora, though copious, is scattered and little co-ordinated. The great *Flora Malesiana* now in preparation will, it is expected, eventually provide a Flora of the island by extraction, but there is nothing of the sort at present. The material on which to base a geographical analysis of the flora has therefore to be culled from many sources, prominent among them being innumerable papers dating from the days of German rule in Kaiser Wilhelms Land ; articles on particular groups, many of them by Dutch workers ; and extensive collections which have been greatly augmented in the last twenty-five years.

Studies of the New Guinea flora with the hope of revealing its degree of relationship with those of various other countries have from time to time been made, but with the one exception of a paper by H. J. Lam (" Materials towards a study of the flora of the island of New Guinea ", in Blumea i : 115–159 (1934)) these have not been very penetrating or detailed. Even Lam's analysis does not, in all respects, cover the

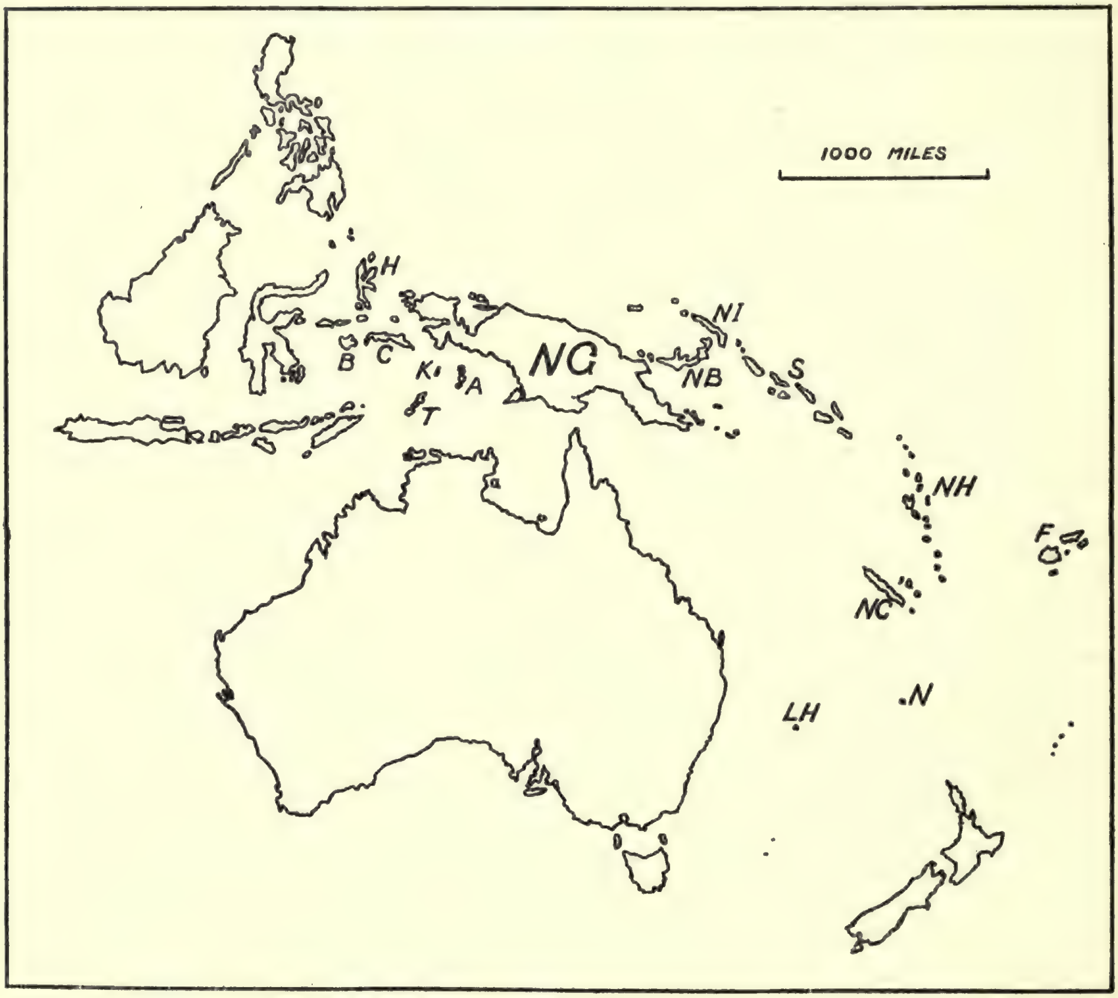


Fig. 1. Sketch-map showing the position of the island of New Guinea (NG) in relation to Malaysia on the west ; to the rest of Melanesia on the east and south-east ; to Australia on the south ; and to New Zealand. Among New Guinea's nearest neighbours west and east are the Moluccan islands of Halmahera (H), Ceram (C) and Buru (B) ; the Aru Islands (A), the Kai Islands (K) and Tanimbar (T) ; New Britain (NB), New Ireland (NI) and the Solomon Islands (S). Further south-east are the New Hebrides (NH), New Caledonia and the Loyalty Islands (NC), Fiji (F), Lord Howe Island (LH) and Norfolk Island (N).

whole of the Flowering Plants, but it is a valuable paper, not only as a source of facts and figures but because it contains an ample survey of the literature of the New Guinea flora up to its date. On this score all that need be added here is to say that most of the serial publications referred to there (including *Blumea* itself) still continue, and that there are two major subsequent sources, namely the *Flora Malesiana* already mentioned, and the series of papers, mainly in the *Journal of the Arnold Arboretum*, primarily describing the great collections made by the Archbold and other expeditions during the later inter-war years. Among shorter recent publications *The Forests and Forest Conditions in the Territories of Papua and New Guinea*, by J. S. Womersley and J. B. McAdam (Government Printer, Port Moresby, 1957), gives a particularly useful outline of the plant life of the island.

The need for a more complete appreciation of the geographical affinities of the New Guinea flora has become more pressing because of the progress which has been made recently in many aspects of the geological and geographical histories of the countries of Australasia. Among these countries New Guinea occupies a highly strategic position (Fig. 1), marking the junction of Malaysia (peninsular and insular tropical south-east Asia), Melanesia (of which it is often reckoned the chief constituent) and Australia. Because of the shallowness of the Arafura Sea, which separates west New Guinea from the Northern Territory of Australia, and the number of small islands or reefs actually in the Torres Strait its link with Australia has always seemed particularly close, but its distance from the Moluccan island of Ceram (Seram) on the west is little greater, though the intervening water is much deeper. From its nearest Melanesian neighbour, New Britain, it is separated by scarcely half these distances.

The special geographical problem of the New Guinea flora is that of determining, both quantitatively and qualitatively, and as closely as may be possible, the degree of relationship between it and the flora of Australia. This is because, although the two regions are now almost completely linked physically, nowhere else in the world is there, over a similar distance, so great a difference in both plant and animal life as there is between the island of New Guinea and the continent of Australia.

Unfortunately this problem has become slightly confused by several more or less irrelevant circumstances. First, Australia was explored botanically earlier than was New Guinea so that many of the genera, and even species, which have been found subsequently to occur in both are commonly thought of and described as " Australian " types, though there may be nothing in the facts to justify this epithet. Second, the flora of New Guinea was for long known principally from the coastal zone only, where the vegetation is most under human influence and where widespread plants are especially in evidence. Third, the most accessible part of New Guinea, southern Papua, is nearest, as well as climatically most similar, to parts of Australia, so that its flora tends to contain not only a larger than average admixture of native plants of Australian affinity, but also introductions from that continent. Besides these there is the rather different point that the more clearly any considerable Australian element can be shown to exist in the New Guinea flora the less puzzling the general problem of the relationship between the two becomes. All these circumstances have tended in the past to exaggerate the importance of the Australian element in the New Guinea flora, and a fresh assessment in the light of our increased knowledge is much to be desired.

It is clearly impossible, without embarking on a prolonged taxonomic study for which the time is probably not yet ripe, to make a statistical analysis of the New Guinea flora right down to species level, but for the re-presentation of the geographical facts of the flora in the light of the recent additions to our knowledge of it, it is enough to go no further than genera, taking species into account only when to do so is particularly revealing (see further remarks on p. 220). The basis of the analysis here is therefore a list of all the genera which have been recorded from New Guinea, either in literature or by personal record. In order to avoid complicating any issues unnecessarily the list refers only to the mainland of New Guinea proper and does not comprehend any of the other islands which may be included in the name Papuasia. The compilation of this list has been greatly facilitated by the prior existence of two similar but independent lists made for more general purposes, one at Leyden and one at the headquarters of the Botany Division at Lae in New Guinea. Thanks to the generous co-operation of Dr. P. van Royen and Mr. J. S. Womersley respectively I have been able to compare mine with these two lists, with great advantage to my own and, I hope, some benefit to the others also. Since the former list is likely to have the widest employment of the three it has been followed here as far as possible without thereby losing sight of any facts of special phytogeographical significance.

It must be emphasized here that neither the list of genera nor the innumerable figures derived from it which appear in the following pages are to be regarded as in any way definitive. They are simply the nearest approximations that it is practicable to make in the present state of our knowledge of the New Guinea flora and every fresh discovery will inevitably modify one or more of them slightly. For this reason it has been thought best to quote them as compilation actually reveals them rather than to round them off in any way, and the apparent exactitude of some of them is not intended to suggest that they are outstandingly accurate. These remarks apply even more strongly when species numbers are quoted.

THE FLORA OF NEW GUINEA

The total number of generic names under which species of the Flowering Plants have been recorded from New Guinea is about 1,850, but this includes not only a number of synonyms but also the names of many plants deliberately or accidentally introduced.

From the point of view of this analysis there are two kinds of synonymy. One is the application of two or more different names to the same plant, and this is not a great problem since it is only necessary to ensure that no plant is considered more than once. The second kind arises from differences of taxonomic opinion by which some workers have recognized more and smaller genera than others, and this can be dealt with only by trying to steer a reasonable course between undue lumping on the one hand and undue splitting on the other. This has as far as practicable been done, and the result is to exclude about 275 names as synonyms and so to reduce the list to about 1,575.

The question of the status of all these genera in New Guinea is much more difficult. In trying to trace the origins and natural relationships of any flora it is essential, as far as possible, to eliminate from consideration plants which have come into the country through human agency and to consider only those which are truly indigenous, that is to say which either existed in the country before the advent of man, or may have entered it since entirely by means unconnected with man's presence, and to recognize these indigenes or natives is not always easy.

Some genera, such as *Ananas, Carica* and *Zea,* are obvious deliberate introductions, but others, such as *Boehmeria, Cananga, Cassia* and *Crateva,* are more doubtful. Many genera occur wholly or especially as weeds and the casual introduction of these seems very probable, though we cannot be sure in all cases, because if a plant is well known in cultivation or as a weed it may nevertheless be a native of New Guinea, as is the case with *Graptophyllum* and *Codiaeum,* now widely familiar in the tropics. Even the description of endemic species is not necessarily evidence that a genus is indigenous, because some such species are most probably no more than local variants of introduced plants. Nor is the absence of endemics indicative of introduction, for there are many indigenous genera represented in the flora only by species occurring elsewhere as well as in New Guinea.

Speaking generally there can be little doubt that the proportion of genera which do in fact owe their presence to the direct or indirect action of man is considerably higher than is usually supposed. Even in the deep interior of the island, where human activity long antedated the coming of European man, there are great extents of grassland which can confidently be regarded as replacements of original forest. Nor is it possible to estimate how long this modification has been going on for there are to be found here the remains of older human cultures quite unknown to the present native peoples. It may indeed be that many of the plants in such situations, though they seem quite at home there, do owe their presence to man. At least we can be sure that the number of introductions has risen sharply in the last hundred years or so, and that it is constantly increasing, making it more and more unlikely that the problem of status will ever now be solved altogether satisfactorily. It is to be remembered too that there must also be classed as introductions those plants which, without man's prior presence in the island, could never have found there the conditions they require. Some of the grasslands just mentioned perhaps had no counterpart in pre-human times and the plants in them may in fact be almost all adventive.

There is perhaps no greater obstacle to the better understanding of the geographical floristic relationships of the world than this problem of recognizing status, and all the indications suggest that it has been much underestimated in the past and the proportion of indigenous genera and species unduly magnified. Here I have treated about 225 genera as being either deliberate or casual introductions of one sort or another. This number is almost certainly smaller than it should be but is as satisfactory as possible in the absence of more evidence.

Thus, after deducting the synonyms and the non-native genera, we are left with a list of 1,350 genera representing what may be called the aboriginal or indigenous and native flora of New Guinea proper, and it is with these genera alone that the following pages are concerned.

Analysis of the indigenous genera of New Guinea

1. *Distribution by families*

(See also Table II)

The 1,350 genera with one or more indigenous species in New Guinea are distributed over some 200 families, or rather more than half of all Angiosperm families, but very unevenly. Of the largest families only the *Labiatae* appear to include no indigenous species, though endemics have been described in more than one genus. The absence of this family is a remarkable feature of the flora, especially since there is a whole group of the family peculiar to Australia. The family *Amaranthaceae* is also entirely unrepresented by indigenous species if a single species which occurs also in Australia is an introduction. In the *Convolvulaceae*, and to a less degree in the *Compositae* and *Cucurbitaceae*, the introductions outnumber the indigenes. Among smaller families unrepresented are the *Phytolaccaceae*, generally widely spread in the tropics; the *Cytinaceae*, for which there would seem to be many possible habitats in New Guinea; and the *Balanopaceae*, known from New Caledonia and Queensland. All three of these may yet be found.

There are no endemic families in New Guinea. About 60 families are represented only by wide (i.e. non-endemic) species. In 75 families there is only one indigenous genus, and in just over half of these there is only one species, more often than not a wide.

From the point of view of a geographical survey the three types of family representation particularly prominent and noteworthy are:

A. *Large families with a strong proportion of endemic species, and usually numerous genera*, namely *Annonaceae, Apocynaceae, Araceae, Asclepiadaceae, Ericaceae* (including *Vacciniaceae*), *Euphorbiaceae, Gesneriaceae, Melastomataceae, Myrtaceae, Orchidaceae, Palmae, Rubiaceae, Rutaceae, Sapindaceae, Sapotaceae, Sterculiaceae, Urticaceae, Verbenaceae, Zingiberaceae.*

These may be regarded as furnishing the bulk foundation of the flora, and absolutely outstanding among them is the family *Orchidaceae*, which with some 128 genera and over 2,600 species, practically all of them endemic, provides the most remarkable single characteristic of the flora as a whole.

B. *Large families with a small proportionate representation of endemic species or none at all*, such as *Compositae, Gramineae, Leguminosae, Scrophulariaceae*, and on a less striking scale *Boraginaceae, Commelinaceae, Cyperaceae, Juncaceae.* In the first three, especially, there are large numbers of introductions and there is a particularly notable contrast between the *Gramineae* and the *Orchidaceae* already mentioned above, the former, though represented by over 80 genera, having only about 70 endemic species. It may be noted, moreover, that the question of status is particularly difficult in the grasses, and the number of truly indigenous genera may well be even smaller than has been assumed.

The contrast of these families with those of A above is another leading character of the flora and one of its most notable negative features.

C. *Smaller families with a notably high proportionate representation and many endemics.* The most important of these are *Araliaceae, Cunoniaceae, Elaeocarpaceae, Icacinaceae, Lauraceae, Loganiaceae, Loranthaceae, Meliaceae, Menispermaceae, Monimiaceae, Moraceae, Myrsinaceae, Opiliaceae, Winteraceae.* Three others of a slightly different kind reinforce these, namely *Begoniaceae,* with about 70 species in two genera ; *Symplocaceae* with about 30 species in one genus ; and *Saurauiaceae* with about 80 species in one genus. It is to these families that many of the most characteristic and ecologically prominent members of the flora belong.

The following two lists show in concise form a number of other features in the representation of families :

1. *Families with* 20 *or more indigenous genera, with approximate numbers of endemic species in parentheses*

Orchidaceae	128	(2,600)	*Acanthaceae*	25	(45)
Gramineae	82	(85)	*Apocynaceae*	25	(84)
Leguminosae	64	(100)	*Cyperaceae*	24	(75)
Rubiaceae	62	(620)	*Annonaceae*	23	(85)
Euphorbiaceae	39	(192)	*Compositae*	22	(77)
Palmae	32	(255)	*Araceae*	21	(106)
Myrtaceae	28	(273)	*Menispermaceae*	21	(26)
Melastomataceae	27	(138)	*Rutaceae*	21	(110)
Sapindaceae	26	(108)			

2. *Families in which more than* 100 *endemic species have been described*

Orchidaceae	2,600	*Urticaceae*	146
Rubiaceae	620	*Lauraceae*	145
Ericaceae	311	*Melastomataceae*	138
Myrtaceae	273	*Asclepiadaceae*	125
Palmae	255	*Myrsinaceae*	116
Zingiberaceae	195	*Pandanaceae*	110
Euphorbiaceae	192	*Rutaceae*	110
Elaeocarpaceae	187	*Sapindaceae*	108
Gesneriaceae	182	*Araceae*	106
Moraceae	171	*Piperaceae*	103
Meliaceae	164		

2. *Geographical distribution of the genera*

(See also Tables I and II)

A survey of the indigenous New Guinea genera on the basis of their geographical distributions outside that country shows that they can be classified into eight main categories, namely :

a. Widespread, and often predominantly temperate, genera.
b. Pantropical genera.
c. Palaeotropical genera.

d. Genera of the Asiatic-Australian and American tropical sectors only.
e. Indomalaysian genera.
f. Australian genera.
g. Remaining non-endemic genera.
h. Endemic genera.

a. Widespread, and often predominantly temperate, genera

These number about 86 and include wide aquatic or subaquatic genera such as *Carex, Juncus* and *Lemna* ; such grasses as *Agrostis* and *Festuca* ; and orchids such as *Habenaria* and *Spiranthes* ; but the majority of them are mainly or entirely temperate genera. Of these latter it is particularly noteworthy that *Clematis, Cotula, Epilobium, Euphrasia, Gaultheria, Myosotis, Ranunculus* and *Wahlenbergia* provide some of the most characteristic members of the New Zealand flora. It may be added that in the genus *Plantago* (and its family) the only non-endemic species out of four occurs elsewhere only in New Zealand.

b. Pantropical genera

The pantropical genera number in all about 244. In some three-quarters of them the number of endemic species is less than five. Many of these are probably not truly indigenous, but the following may be given as examples :

Bauhinia, Combretum, Connarus, Ehretia, Erythroxylum, Hibiscus, Hippocratea, Homalium, Justicia, Parkia, Passiflora, Rauvolfia, Rinorea, Ruellia, Securidaca, Uvaria, Zanthoxylum.

In the other 60 or so genera the numbers of endemic species run up to over 500, the most notable examples being :

Bulbophyllum (558), *Eugenia* (*sensu lato*) (180), *Ficus* (150), *Elaeocarpus* (120), *Psychotria* (120), *Malaxis* (*Microstylis*) (89), *Piper* (86), *Begonia* (60), *Schefflera* (55), *Cryptocarya* (47), *Calanthe* (38), *Ardisia* (37), *Ixora* (32), *Solanum* (32), *Symplocos* (31).

c. Palaeotropical genera

The palaeotropical genera number 169 in all and again in about three-quarters of them the number of endemic species is less than five. Examples of these are :

Alangium, Amorphophallus, Antiaris, Borassus, Bridelia, Callicarpa, Cassytha, Ceropegia, Cirrhopetalum, Exacum, Flacourtia, Flagellaria, Grewia, Mangifera, Myrsine, Olax, Pavetta, Phaius, Pterygota, Rungia, Tylophora, Ventilago.

Outstanding among the forty or so genera with more than five endemic species are :

Oberonia (84), *Medinilla* (64), *Calamus* (57), *Garcinia* (55), *Pandanus* (51), *Macaranga* (46), *Evodia* (45), *Myristica* (38).

d. Genera of the Asiatic-Australian and American tropical sectors only

These number in all only 27 but the category is an interesting one in comparison with the palaeotropical (African and Asiatic-Australian) category already mentioned. The genera, with the numbers of their endemic species, are :

Saurauia (84), *Eurya* (20), *Homalomena* (17), *Weinmannia* (12), *Erythrodes*

(*Physurus*) (9), *Perrottetia* (6), *Meliosma* (3), *Gordonia, Astilbe, Sapindus* and *Turpinia* (2 each), *Anotis, Antirhea, Erechthites, Gymnopogon, Muhlenbergia, Phrygilanthus, Spathiphyllum* and *Talauma* (1 each), and *Nelumbo, Laplacea* and *Lespedeza* with none. To these are to be added five slightly aberrant genera: *Ternstroemia* (10) which has one species in Angola and one in Tanganyika Territory; *Clethra* (1), with a species in Macaronesia; *Coriaria* (1) and *Styrax* (1), each with a species in Europe; *Cynoctonum* (0), with two species in Madagascar. It is to be noted that four of these genera belong to the comparatively small family *Theaceae*, and that *Weinmannia* and *Coriaria* are found in New Zealand.

e. Indomalaysian genera

Under the term " Indomalaysian " are included all the genera whose distributions are predominantly outside, and to the west and north-west of New Guinea, as far, it may be, as India or China or Japan. It thus includes such distributions as from India to Polynesia and New Zealand, that is to say " Indo-Australasian " in the widest sense, or much more narrowly from some part of the western Malaysian Archipelago to New Guinea, such as is often described as " Malaysian ". Thus the category is susceptible to much fine division in detail, and this is well, because it is by far the largest geographical category in the flora, containing 494 genera, many of them well represented by endemic species. About one-fifth of these are " Malaysian" rather than " Indomalaysian " in the above sense.

Twenty-six of the genera included here have in fact been recorded, usually as a single species, from some part of the Madagascar Region, but some of these involve the question of status there and it has been thought unwise to separate them as a distinct category. They are :

Agrostophyllum, Alyxia, Amaracarpus, Atylosia, Calpidia, Cerbera, Dimeria, Erythrospermum, Galeola, Geniostoma, Garnotia, Hedychium, Lepironia, Melastoma, Nepenthes, Orchipeda, Pipturus, Pothos, Samadera, Schizostachyum, Strobilanthes, Strongylodon, Thoracostachyum, Thuarea, Timonius, Zoysia.

It is to the Indomalaysian category that many of the genera with the largest numbers of endemic species belong, among notable examples being :

Cyrtandra (97), *Aglaia* (70), *Alpinia* (68), *Riedelia* (65), *Freycinetia* (59), *Hoya* (59), *Timonius* (57), *Dimorphanthera* (55), *Hydnophytum* (52), *Dysoxylum* (46), *Helicia* (41), *Ophiorrhiza* (40), *Licuala* (34), *Chisocheton* (33), *Fagraea* (31), *Aeschynanthus* (30), *Litsea* (30),

and the following genera of *Orchidaceae* :

Dendrobium (619), *Phreatia* (114), *Taeniophyllum* (88), *Eria* (71), *Glomera* (71), *Ceratostylis* (63), *Agrostophyllum* (45), *Mediocalcar* (36), *Glossorhyncha* (35), *Microtatorchis* (34), *Appendicula* (32), *Podochilus* (30).

f. Australian genera

Broadly speaking, the facts and categories so far discussed are among the more familiar concerning the New Guinea flora. Much the same is true of the category of endemic genera to be dealt with a little later, but with the other two categories, the " Australian " and the " remaining non-endemic " genera, to which we must now pass, the situation is rather different and it is chiefly with these that some misconceptions have arisen in the past. Their consideration therefore calls for some preparatory comments.

The first concerns the meaning, in this connexion, of the word " Australian ". There is little doubt as to the intended implication of the word, namely that genera so called are genera of Australian origin and particularly characteristic of the flora of that continent. Unfortunately there is seldom, if ever, any direct evidence for the place of origin of a genus, and we can therefore only assume such to be the case on collateral evidence. This evidence too is difficult to find and unconvincing when it is found, so that we are in practice reduced to some more arbitrary definition, such, for example, as that " Australian " genera are genera of which the bulk of the species are members of the flora of Australia and which have a wider range within that continent than outside. It will probably be agreed that this is as near a definition of an " Australian " genus as it is possible to get, and when that geographical adjective is used here this is the intended meaning of it. The only ready alternative to this would be to call " Australian " all genera occurring in that continental flora irrespective of their distribution or numbers of species outside and this would manifestly be unreasonable. We may therefore accept that a genus meriting the description " Australian " is one in which the bulk of the species are found in Australia and, generally, whose distribution within that continent is greater, or at least more concentrated, than it is outside.

When this definition is carefully applied to the 1,350 or so indigenous genera of New Guinea it will be found that only 62 genera conform to it. Not only so but the details relating to the occurrence of some of these in New Guinea suggest that they have little real claim to be so regarded. These are important conclusions because, for the reasons mentioned earlier, there has long been an understandable tendency to think of the Australian element (as it may be called) in the New Guinea flora as something more considerable than it really is, and this has in turn lent false colour to some speculations about the origins and relationship of the floras of the two regions. It is therefore very desirable that the relevant facts about the occurrence of these 62 genera should be stated as clearly as space permits, and the following review of them is for this purpose. Lest any unwarranted implications should accidentally arise they are dealt with alphabetically. These genera are :

Acacia (*Leguminosae*). Widely tropical in distribution but very characteristic of and well represented in the Australian flora, where there are hundreds of endemic species. Five species have been recorded from New Guinea of which *A. pennata* is a wide Old World species ; *A. manglesii* is also in Malaysia and Australia ; and the other three are in Australia also. *A. pseudoarabica* is apparently not maintained as a New Guinea endemic.

Agonis (*Myrtaceae*). A genus allied to *Leptospermum*. One, or perhaps more, of the 12 or so Australian species occurs also in New Guinea.

Arthropodium (*Liliaceae*). A genus with five species in Australia ; one in Australia and New Guinea (*A. strictum*) ; three in New Zealand and one in New Caledonia.

Backhousia (*Myrtaceae*). A genus with about seven species in Australia, mostly in the Queensland rain-forests, and two in New Guinea.

Baeckea (*Myrtaceae*). This genus ranges from south-east Asia to New Caledonia (where there are several endemics), but the great majority of the 100 or so species are in Australia. One wide species is recorded for New Guinea.

Banksia (*Proteaceae*). A characteristic Australian genus of about 50 species; represented in New Guinea only by *B. dentata*, which is also in northern Australia.

Brachychiton (*Sterculiaceae*). Usually quoted as wholly Australian, and with several species in the Queensland rain-forests, but *B. carruthersii* has been described from New Guinea. This species however has also been included in *Sterculia*, a wide tropical genus.

Brachycome (*Compositae*). A genus placed near *Bellis*, *Lagenophora* and *Myriactis*. Predominantly Australian (about 40 species), but there are five species in New Zealand, two in New Caledonia, and one, endemic, in New Guinea.

Caesia (*Liliaceae*). One of the six Australian species has fairly recently been recorded in Malaysia, including New Guinea, and there are also three species in South Africa.

Calogyne (*Goodeniaceae*). A characteristic genus in Australia, where there are eight species. One of these extends through New Guinea and the Philippines to south-east Asia.

Casuarina (*Casuarinaceae*). Mr. L. A. S. Johnson (in litt.) recognizes two easily distinguished groups of this genus, one entirely Malaysian–Melanesian except for a single very restricted species in north-east coastal Queensland; the other mainly Australian but found also in Java, Celebes, the Lesser Sunda Islands, New Guinea and New Caledonia. He makes 66 species in all (some yet undescribed) and about 40 of these are confined to Australia, more than half of them to the south-west. Seven species occur in New Guinea, four of them belonging to the first part of the genus, and three of them to the second. Two of them, one from each part, are endemic to New Guinea, the others occurring elsewhere in Malaysia also. One of these, the widely distributed and often planted *C. equisetifolia*, is the only species common to Australia and New Guinea.

Centrolepis (*Centrolepidaceae*). More than 30 of the species are Australian, one of them being in New Zealand also. The genus is also in Tonkin, Borneo, the Philippines and New Guinea. The last-named has two species, one of them also in Australia and the other also in Malaysia.

Ceratopetalum (*Cunoniaceae*). This genus has five species in Queensland and New South Wales in rain-forests, and one of these has been recorded from New Guinea.

Citriobatus (*Pittosporaceae*). One of the four species of this small Australian genus has recently been recorded from New Guinea, Celebes and the Philippines.

Cladium (*Cyperaceae*). A very widespread genus but with most of its 30 species in Australia. The New Guinea representatives of the genus include five endemic species.

Cleistochloa (*Gramineae*). One of the two species of this Queensland grass genus has recently been recorded from New Guinea.

Daphnandra (*Monimiaceae*). This genus has six species, four in Australia, mostly in rain-forests, and two in New Guinea. It is closely related to *Atherosperma* (characteristic of Tasmanian rain-forest) and allied also to *Laurelia* of New Zealand.

Dissiliaria (*Euphorbiaceae*). A genus of three species in Australia, of which *D. tricornis* has recently been recorded also from New Guinea.

Dodonaea (*Sapindaceae*). There is one pantropical species which, together with a single endemic, has been recorded from New Guinea, but almost all the 50 or so others are in Australia.

Drakaea (*Orchidaceae*). An Australian genus of four species of which one (*D. irritabilis*) has recently been recorded from New Guinea.

Drosera (*Droseraceae*). A genus of almost world-wide distribution and particularly well represented in Australia where there are most of its 90 species, especially in the south-west. Six species are recorded from New Guinea. One of these, *D. petiolaris*, is also in northern Australia, but the others—*D. burmanni*, *D. indica*, *D. spathulata*, *D. peltata* and *D. rotundifolia*—are wide species without any special Australian affinity.

Ectrosia (*Gramineae*). An Australian genus of some 12 species, one of which is also in New Guinea.

Epacris (*Epacridaceae*). A genus with about 45 species in Australia, one of which is also recorded from New Guinea. There is also one species in New Zealand and New Caledonia, and one in New Zealand only.

Eucalyptus (*Myrtaceae*). The genus is overwhelmingly Australian, with several hundred species there, but it occurs as far north as the Philippines. Nine species are found outside Australia. Of the seven of these which are in New Guinea, four are also in Australia ; one may be endemic ; *E. deglupius* is also in the Philippines but not in Australia ; while *E. albus* is also in Timor, Wetar, Flores, Sumba and north Australia.

Exocarpus (*Santalaceae*). A genus of about 20 species, half of them in Australia and the rest ranging over New Zealand, Norfolk Island, eastern Malaysia, the Bonin Islands, New Caledonia and Hawaii. Of the three species in New Guinea two are endemic and belong to a section elsewhere only in the Moluccas; the third belongs to the subgenus in which are most of the Australian species and may occur there also.

Fenzlia (*Myrtaceae*). A genus closely related to *Myrtella* and *Rhodomyrtus*, with four Australian species, one of which has been recorded also from New Guinea.

Flindersia (*Rutaceae*). Fifteen of the 20 species of this genus are in Australia, mainly in rainforest, but there are three endemics in New Guinea, one in New Caledonia and more than one in Amboina.

Gahnia (*Cyperaceae*). This genus ranges from China and Japan, through Malaysia, to Australia, New Zealand, Hawaii and Rapa (Oparu). About half its 40 species are in Australia, and it is well represented also in New Zealand and Hawaii. Only one wide Malaysian species occurs in New Guinea.

Geijera (*Rutaceae*). A genus with about 6 species in Australia, one of which, *G. salicifolia*, has recently been recorded from New Guinea. There is one species in Australia and New Caledonia, and two others are in New Caledonia only.

Geitonoplesium (*Liliaceae*). A genus of perhaps only a single species which occurs in Australia, New Guinea and New Caledonia.

Gompholobium (*Leguminosae*). A characteristic Australian genus of 25 species, one of which, *G. nitidum*, has recently been recorded in New Guinea.

Grevillea (*Proteaceae*). A large and characteristic Australian genus of about 200 species, known elsewhere in Celebes (one species), New Caledonia (12 species) and New Guinea, where there are one endemic species (*G. papuana*) and two which occur also in Australia.

Haemodorum (*Haemodoraceae*). A characteristic Australian genus of about 20 species, mostly in the north of the continent. One of the earlier-described Australian species has been recorded from New Guinea.

Haloragis (*Haloragaceae*). A genus of about 80 species ranging from India and Japan, through Malaysia, to Australia, New Zealand, Rapa and Juan Fernandez. About three-quarters of the species are in Australia. New Guinea has six endemics and two wide species.

Helichrysum (*Compositae*). A large and widely distributed Old World genus particularly well represented in South Africa and Australia and to a lesser degree in New Zealand. The four New Guinea species often attributed to it have been considered to form an endemic genus (*Hecatactis*).

Hibbertia (*Dilleniaceae*). A large and predominantly Australian genus with about 100 species in the continent. There are also 18 in New Caledonia, one in Fiji and one in Madagascar. In New Guinea it is represented by two of the Australian species only, *H. banksii* and *H. scandens*, an earlier-described endemic being no longer maintained.

Keraudrenia (*Sterculiaceae*). A genus usually described as having seven species in Australia and one in Madagascar. One (or possibly two) of the Australian species has been reported from New Guinea.

Lechenaultia (*Goodeniaceae*). There are about 20 Australian species of this genus, one of which has been reported in New Guinea.

Lepidosperma (*Cyperaceae*). The genus ranges from south-east Asia to New Caledonia and New Zealand, but nearly all the 40 species are in Australia. One wide species is recorded from New Guinea.

Leptocarpus (*Restionaceae*). A genus with about a dozen species in Australia, one in Cochin

China, one in New Zealand and one in Chile. One of the Australian species, *L. elatior*, occurs in New Guinea.

Lomandra (*Liliaceae*). A genus of some 30 Australian species of which one is also in New Guinea and New Caledonia.

Melaleuca (*Myrtaceae*). One species ranges from south-east Asia to New Caledonia, including New Guinea, but there are well over 100 Australian species, one of which has also been recorded from New Guinea.

Microtis (*Orchidaceae*). A small genus, mostly Australian but said to range from New Zealand and New Caledonia over Malaysia to India. Its occurrence in New Guinea apparently rests on a little-known plant which has been called *M. papuana*.

Mitrasacme (*Loganiaceae*). A genus mostly Australian but also in New Caledonia and New Zealand. Represented in New Guinea by the wide Indomalaysian *M. nudicaulis* and by an otherwise Australian species, *M. elata*.

Myoporum (*Myoporaceae*). A genus of about 30 species ranging from south-east Asia to Australia, New Zealand, Hawaii, Rapa and Rarotonga, and with an outlying species in Mauritius. More than half the species are in Australia, and New Zealand has only one. It is represented in New Guinea by *M. papuanum*, presumably endemic, and by *M. tenuifolium* which is also in New Caledonia and Queensland.

Olearia (*Compositae*). A genus of more than 100 species, nearly all of them in Australia and New Zealand in the proportion of two in the former to one in the latter. About a dozen endemics have been described from New Guinea and their affinities call for examination.

Patersonia (*Iridaceae*). A genus of about 20 species, all Australian except for one in Borneo and the Philippines and one in New Guinea, *P. novoguineensis*.

Pimelea (*Thymelaeaceae*). A genus of about 80 species, predominantly Australian but with 15 species in New Zealand, and known also from Timor and Lord Howe Island. It is presumably one of the Australian species which has recently been reported from New Guinea.

Pittosporum (*Pittosporaceae*). This large and widespread genus of the Old World has its heaviest concentrations of species in New Zealand and New Caledonia, but lesser ones in Australia, the Philippines, Madagascar and Hawaii. The *Flora Malesiana* gives 5 species for New Guinea, two of them endemic (various others have been described) and only one of the other three in common with Australia.

Pterostylis (*Orchidaceae*). Nearly all the 90 or so species of this genus are in Australia and New Zealand, but there are also two in New Caledonia and two in New Guinea.

Ptilotus (*Amaranthaceae*). A characteristic Australian genus with about 70 species, one of which, *P. conicus*, occurs in parts of Malaysia and has recently been reported from New Guinea.

Ripogonum (*Smilacaceae*). A small genus with two groups, in one of which there are 4 Australian species, one common to Australia and New Guinea, and one endemic to New Guinea. In the other there is a single well-known New Zealand species.

Scaevola (*Goodeniaceae*). A characteristic Australian genus of about 100 species, two of which are widespread tropical strand-plants. There are a few species in New Caledonia, and perhaps in Polynesia, and two endemics have been described from New Guinea, though one may not be so.

Schelhammera (*Liliaceae*). A genus of two Australian species, one of which, *S. multiflora*, was long ago recorded from New Guinea.

Schoenus (*Cyperaceae*). Another widespread genus of sedges, with most of its 65 species in Australia. Two endemics and several wides are recorded from New Guinea.

Stackhousia (*Stackhousiaceae*). All but one of the 25 species are Australian, and there is another only in New Zealand. One of the Australian species is found also in New Guinea, Sumatra, Celebes, the Philippines, the Moluccas and Micronesia.

Stylidium (*Stylidiaceae*). A large and characteristic Australian genus of about 100 species, with a thin but wide representation over Indomalaysia. Two species occur in New Guinea—*S. alsinoides* of northern Australia, Celebes and the Philippines, and *S. schizanthum* of northern Australia and the Fly River area of New Guinea.

Thelymitra (*Orchidaceae*). A genus characteristic of Australia (45 species) and New Zealand

(20 species) but with four other species in New Guinea, New Caledonia, Timor and Java respectively. The New Guinea endemic is said to be most closely allied to some of the New Zealand species.

Thysanotus (*Liliaceae*). A characteristic Australian genus of about 20 species. Of the two species recorded from New Guinea one is also in Australia, and the other is distributed from Australia to south-east Asia.

Trachymene (*Umbelliferae*). A somewhat confused genus with most of its 26 species in Australia. New Guinea has 8 endemics, one species found also in Celebes, and one found also in Australia, Borneo and the Philippines. There is also an endemic species in New Caledonia.

Tricoryne (*Liliaceae*). An Australian genus of some six species. One of these, *T. platyptera*, has recently been recorded from southern New Guinea.

Velleia (*Goodeniaceae*). One species of the 18 in this Australian genus, *V. spathulata*, has been recorded from south-east New Guinea.

A careful study of the facts in the above review reveals several interesting features which serve to diminish rather than to enhance the importance of these " Australian " genera in the flora of New Guinea. Thus :

1. The total number of New Guinea endemic species in *all* these genera is only 64 and nearly half of these are in *Olearia*, *Trachymene*, *Haloragis*, *Cladium* and *Helichrysum*. Such wide and characteristic Australian genera as *Acacia*, *Banksia*, *Drosera*, *Epacris*, *Gompholobium*, *Haemodorum*, *Hibbertia*, *Lechenaultia*, *Lomandra*, *Pimelea*, *Ptilotus*, *Stackhousia*, *Stylidium*, *Thelymitra* and *Thysanotus* have none : *Eucalyptus*, *Grevillea* and *Myoporum* have only one each ; *Casuarina* only two.

2. 16 out of the 62 genera are in Australia and New Guinea *only*. These have only 7 New Guinea endemics between them, compared with upwards of 300 in Australia.

3. Several of the genera, e.g. *Stackhousia* and *Stylidium*, have one or more species fairly widely distributed in Indomalaysia, and most of these genera are represented in New Guinea only by one or more such species.

4. Several of the genera, e.g. *Cladium*, *Drosera* and *Schoenus*, are very widespread and " Australian " only in the arbitrary sense used here that their species concentration is greatest in the continent of Australia.

5. Most of the genera represented in New Guinea only by a single Australian species, e.g. *Caesia*, *Cleistochloa*, *Drakaea*, *Ectrosia*, *Gompholobium*, *Pimelea*, *Ptilotus* and *Tricoryne*, are of recent report and are possibly introduced.

6. It will be noted that the names of New Caledonia and of New Zealand recur with notable frequency. Of the 62 genera, 6 occur in New Zealand—*Centrolepis*, *Leptocarpus*, *Olearia*, *Pimelea*, *Ripogonum* and *Stackhousia* : 13 occur in New Caledonia—*Acacia*, *Baeckea*, *Casuarina*, *Dodonaea*, *Flindersia*, *Geijera*, *Geitonoplesium*, *Grevillea*, *Hibbertia*, *Lomandra*, *Melaleuca*, *Scaevola* and *Trachymene* ; and 17 occur in *both*—*Arthropodium*, *Brachycome*, *Cladium*, *Drosera*, *Epacris*, *Exocarpus*, *Gahnia*, *Haloragis*, *Helichrysum*, *Lepidosperma*, *Microtis*, *Mitrasacme*, *Myoporum*, *Pittosporum*, *Pterostylis*, *Schoenus* and *Thelymitra*.

7. There is much still to be learnt about the distribution of these 62 genera within New Guinea but it can be said that few if any of their members are among the more widespread or important plants in the New Guinea flora. Some of them have a very restricted range there, and others occur only in those areas most closely adjacent to Australia.

g. *Remaining non-endemic genera*

These number about 126 and can be divided into three sub-categories :

1. Balanced genera of Australia and New Guinea

These are 18 small genera, entirely or virtually confined to Australia and New Guinea, but more or less equally balanced between the two, though, as might be expected, the actual range within Australia is often greater than in New Guinea. In 8 of them—*Cycnogeton* (included by some authors under the widespread genus *Triglochin*), *Eustrephus, Hymenosporum, Osbornia, Phacellothrix, Tecticornia, Torrenticola* and *Vandasia*—a single species occurs in both regions. *Bouchardatia, Gillbeea, Helmholtzia, Himantandra, Kissodendron* and *Piptocalyx* are generally regarded as having one species in *each* region. In *Carronia, Eupomatia* and *Pleiogynium* there are two species in one or both regions. In *Toechima* there are four species in Australia and four in New Guinea.

2. Southern, and mostly predominantly temperate, genera

In total these number 24 and it is of great interest that so many should occur in such equatorial latitudes as New Guinea. Moreover these are mostly genera much more characteristic of, and well represented in, New Zealand than Australia, e.g. *Coprosma* and *Hebe*. The most typical of this sub-category are *Abrotanella, Acaena, Astelia, Carpha, Coprosma, Drapetes, Drimys, Gaimardia, Gunnera, Hebe, Lagenophora, Libertia, Muehlenbeckia, Nertera, Nothofagus, Oreobolus, Oreomyrrhis, Pratia, Uncinia* and *Vittadinia*. The two Proteaceous genera *Gevuina* and *Oreocallis* are unlike all the rest in being absent from New Zealand. More anomalous but best included in this sub-category are *Iphigenia* and *Metrosideros* both of which occur in Africa but not in America. *Metrosideros* offers special problems because it is very much a New Zealand genus, but has only a single tropical species in Australia and only a single species in South Africa, where it has no close relatives.

3. Remainder

The geographical distribution of the remaining 84 non-endemic genera is not only extremely varied, especially in respect of Melanesia, but in some cases is still not properly known. They are all alike however in being generally restricted to an area comprising the Philippines, the Moluccas, Celebes, Timor and the Lesser Sunda Islands, north-east Australia, the Solomons, the New Hebrides, Fiji, Polynesia, Micronesia, New Caledonia and New Zealand, though occasionally and anomalously a genus may occur somewhere outside these limits.

Within this general category four groups can be recognized fairly easily. Ten genera may be described as subendemic to New Guinea, being found, elsewhere, only in Australia or the Bismark Archipelago, or occasionally in both. The genera which appear to have this distribution are *Epiblastus, Hydriastele, Kentia, Levieria, Linospadix, Mackinlaya, Neosepicaea, Peekeliopanax, Tripetalum* and *Trochocarpa*. Twenty others are *not*, outside New Guinea, found east of New Guinea/Australia. These are *Althoffia, Ascoglossum, Calymmanthera, Calyptrocalyx, Camptostemon,* *Coelopyrena, Cominsia, Gronophyllum, Heterospathe, Kjellbergiodendron, Lepiniopsis, Mearnsia, Merrilliodendron, Palmeria, Pseudotrophis, Ptychandra, Rhopaloblaste, Scaphiophora, Schizomeria* and *Steganthera*. Another 18 genera occur, outside New Guinea, *both* west and east of New Guinea/Australia, namely *Archidendron, Ascarina, Badusa, Corynocarpus, Couthovia, Dolicholobium, Drymophloeus, Gulubia, Haplolobus, Mastixiodendron, Microlaena, Paratrophis, Santalum, Soulamea, Wenzelia, Xanthostemon* and anomalously, since they are reported from Borneo, *Durandea* and *Faradaya*.

Finally there are 36 genera which, outside New Guinea, occur *only* east of New Guinea/Australia. These are particularly varied in distribution but almost every one of them is of particular interest in some way or other from the point of view of the flora of New Guinea. The following list of them will, it is hoped, enable anyone wishing to study them further to do so more easily—*Acianthus, Ackama, Agatea, Airosperma, Amyema, Antholoma, Astronidium, Batis, Belliolum, Bubbia, Calochilus Carpodetus, Cupaniopsis, Dallachya, Delarbrea, Dubouzetia, Euroschinus, Eurycentrum Finschia, Halfordia, Hedycarya, Meryta, Moerenhoutia Plerandra, Pseudomorus, Ptychococcus, Ptychosperma, Pullea, Raoulia, Sararanga, Sphenostemon, Spiraeanthemum, Stenocarpus, Tapeinosperma, Trimenia, Tupeia*.

It may be added that of the 54 genera in the last two groups 25 occur in Australia ; 26 in New Caledonia ; 15 in Fiji ; and 11 in New Zealand.

h. Endemic genera

As already stated there is no endemic family in the New Guinea flora. The endemic genera appear to number about 140, and to represent about 50 families, and the number of species in them is some 355. Ninety of the genera are monotypic, and the average number of species per genus is 2·5 (see Table I). Only seven genera have more than 10 species, namely *Paralinospadix* (21), *Rhyticaryum* (20), *Chitonanthera* (19), *Nengella* (19), *Sericolea* (16), *Cyrtandropsis* (15) and *Symbegonia* (12.)

The Numbers of Species

The lack of a complete published Flora of New Guinea is particularly felt when questions about the numbers of species arise. It is true that many species figures have been quoted in the foregoing pages, but this has only been to enable some comparison to be made between different genera, and the figures are not claimed to be definitive in any way. There are, however, two figures of such special interest that some definite attempt must be made to arrive at them. These are the total number of indigenous species in the flora, and the proportion of endemics among them.

As regards endemics the situation is easier because the *Index Kewensis* at least tells us how many in total *have been described*, and it only remains to decide in what measure this is an accurate reflection of the facts. It is likely in some large genera, such as various of the orchids, that there is considerable duplication, because new species have been described concurrently by workers in different countries, but against this it is noticeable that when a genus with a reasonably large number of species is carefully revised and monographed new species, hitherto unrecognized, are usually discovered, and these often restore the *Index* figure by making good the loss through synonymy. On the other hand in smaller genera represented perhaps by only one or two species in New Guinea there seems to have been a general tendency in the past to describe as endemic species forms which have later been considered no more than local versions of wide species. A further point to remember is that there are certainly many new species yet to be described, though the number of these is an imponderable.

Weighing these considerations together it would seem that the total of endemic species as shown in the *Index Kewensis*—up to and including the recently published Twelfth Supplement (1959)—is probably sufficiently near the truth to be acceptable in general terms. This figure is nearly 8,500 (see Table I).

The wide species are more troublesome to estimate because they can only be assembled by searching through the scattered literature, and also because the number of names under which they appear is greater. Their estimation is also greatly confused by the problem of status, and there is reason to suspect that some of the widespread species do in fact owe their presence in New Guinea to human influence. It is therefore difficult to come to any very definite conclusion as to the number of these species but the indications suggest that the proportion of the wide species in the flora is between 5 and 10 per cent, and possibly nearer the latter than the former.

These two figures give an overall figure for the indigenous flora of New Guinea as a whole of about 9,000–9,250, a notably high figure in comparison with many other areas of similar size.

Not unnaturally the proportion of specific endemism varies greatly in the different families. There are at least 60 families with no endemics at all. These are mostly aquatics, strand or mangrove plants, or parasites, but they appear to include also

Table I

Summary of geographical generic categories and endemic species

	Total genera	Genera with endemic species	Total endemic species	Col. 3 / Col. 1	Col. 3 / Col. 2
a. Widespread genera .	86	54	579 (128)	6·7	10·7
b. Pantropical genera .	244	156	2,338 (689)	9·6	15·0
c. Palaeotropical genera	169	107	829 (125)	4·9	7·7
d. Asiatic-American genera . . .	27	21	184 (9)	6·8	8·8
e. Indomalaysian genera.	494	250	3,576 (1,565)	7·2	14·3
f. Australian genera .	62	24	64 (4)	1·0	2·7
g. Other non-endemic genera . . .	126	87	538 (50)	4·3	6·2
h. Endemic genera .	140	140	355 (50)	2·5	2·5
TOTALS . . .	1348	839	8,463	6·2	10·0

The figures in parentheses are those of the *Orchidaceae* only and in *a* include *Liparis* with 76, and in *b Bulbophyllum* with 558 and *Malaxis* with 89.

Table II

Geographical categories of the genera in the families represented in the New Guinea flora by more than twelve genera

The highest figure in each family is underlined

	Total Genera	Introductions	Widespread	Pantropical	Palaeotropical	Asia-America	Indomalaysian	Australian	Other wides	Endemic	
Orchidaceae . .	128	–	6	7	9	1	75	4	9	17	
Gramineae . .	113	31	11	30	12	2	21	2	1	3	
Leguminosae . .	82	18	–	34	8	1	14	2	2	3	
Rubiaceae . .	63	1	1	14	10	2	20	–	8	7	
Compositae . .	62	40	5	1	1	1	1	3	5	5	
Euphorbiaceae .	44	5	1	6	10	–	18	1	–	4	
Palmae . .	33	1	–	–	2	–	13	–	12	5	
Apocynaceae . .	30	5	–	2	4	–	10	–	2	7	
Myrtaceae . .	29	1	–	4	–	–	8	6	5	5	
Sapindaceae . .	28	2	–	1	2	1	17	1	2	2	
Acanthaceae . .	27	2	–	8	6	–	4	–	–	7	
Melastomataceae .	27	–	–	–	3	–	16	–	1	7	
Annonaceae . .	24	1	–	2	3	–	12	–	–	6	
Cyperaceae . .	24	–	5	8	–	–	3	4	3	1	
Rutaceae . .	22	1	–	1	3	–	7	2	3	5	
Araceae . .	21	–	–	2	1	2	13	–	–	3	
Asclepiadaceae .	21	5	–	1	6	–	6	–	–	3	
Menispermaceae .	21	–	–	1	1	–	14	–	1	4	(only 31 spp. in all)
Moraceae . .	19	3	–	1	1	–	8	–	3	3	
Scrophulariaceae .	18	4	2	3	4	–	3	–	1	1	
Anacardiaceae .	17	2	–	3	2	–	5	–	2	3	
Zingiberaceae .	17	1	–	2	2	–	11	–	–	1	
Araliaceae . .	16	–	–	1	2	–	5	–	6	1	
Loranthaceae .	16	–	–	–	2	1	4	–	9	7	
Sterculiaceae . .	16	2	–	3	4	–	5	2	–	–	
Cucurbitaceae .	15	8	–	1	2	–	4	–	–	–	
Myrsinaceae . .	15	–	–	2	4	–	6	–	1	2	
Urticaceae . .	15	–	1	4	4	–	5	–	–	1	
Verbenaceae . .	15	4	–	3	2	–	4	–	1	1	
Flacourtiaceae .	14	2	–	3	3	–	5	–	–	1	
Gesneriaceae . .	14	–	–	–	1	–	9	–	–	4	
Icacinaceae . .	14	–	–	–	2	–	8	–	1	3	
Labiatae . .	14	14	–	–	–	–	–	–	–	–	
Meliaceae . .	14	1	–	–	1	–	12	–	–	–	
Convolvulaceae .	13	11	–	–	1	–	1	–	–	–	
Lauraceae . .	12	–	–	3	1	–	7	–	–	1	

the *Chenopodiaceae, Chloranthaceae, Droseraceae, Juncaceae, Lythraceae, Malpighiaceae* and *Simaroubaceae,* as well as a group of Australian families.

The great majority of endemics are thus found in only about 150 of the families, and here again the figures vary widely. For instance the proportion of endemics is unusually low in *Gramineae* (c. 50 per cent), *Sterculiaceae* (65 per cent), *Leguminosae* (70 per cent), *Cyperaceae* (75 per cent) and *Menispermaceae* (75 per cent). On the other hand *Acanthaceae, Anacardiaceae, Annonaceae, Apocynaceae, Araceae, Araliaceae, Asclepiadaceae, Gesneriaceae, Icacinaceae, Meliaceae, Myrsinaceae, Myrtaceae, Palmae, Rubiaceae, Rutaceae, Sapindaceae, Urticaceae* and *Zingiberaceae* probably have more than 95 per cent of endemics. In the *Orchidaceae* only about half-a-dozen species out of 2,600 appear to be wides. Finally it may be that in *Cunoniaceae* (65 species), *Elaeocarpaceae* (186), *Ericaceae* (311), *Lauraceae* (144), *Monimiaceae* (80), and possibly one or two others, *all* the species are endemic.

Further Australasian relationships of the New Guinea flora

Although the particular interest of the indigenous flora of New Guinea lies in the nature and degree of its relationships with the flora of the continent of Australia, its relations with the floras of certain other parts of Australasia, notably Tasmania, New Zealand and New Caledonia, are almost equally important, and this study may appropriately be concluded with a brief comparative presentation of the relationships between all these five at generic level.

Of the 1,350 or so indigenous genera of the New Guinea flora :

a. Over 700 (more than 50 per cent) are members also of the flora of continental Australia ;
b. About 385 (some 30 per cent) are members also of the flora of New Caledonia ;
c. About 165 (some 13 per cent) are members also of the flora of New Zealand ;
d. About 150 (11 per cent) are members also of the flora of Tasmania ;
e. About 120 occur in the floras of *both* New Zealand *and* Tasmania.

About 60 genera occur in all the five regions, namely New Guinea, Australia, Tasmania, New Caledonia and New Zealand. Rather naturally these include many very widespread genera but among the others there may be mentioned *Arthropodium, Astelia, Brachycome, Dianella, Elaeocarpus, Erechthites, Exocarpus, Gahnia, Lagenophora, Libertia, Mitrasacme, Muehlenbeckia, Myoporum, Nertera, Parsonsia, Pittosporum, Thelymitra* and *Uncinia.* In *Astelia* the continental Australian distribution is limited to the extreme south-east.

The genera which occur in New Guinea and also in three out of the four other regions mentioned number about 90, the largest group being that in which the genera are present in New Guinea, Australia, Tasmania and New Zealand but absent from New Caledonia. The 40 or so genera here not unnaturally include many widely distributed temperate genera such as *Lobelia, Epilobium* and *Ranunculus,* but also some southern genera, among them *Acaena, Drimys, Hebe* and *Nothofagus.*

The genera which are in New Guinea, Australia, New Caledonia and New Zealand, but which are absent from Tasmania, number 28. Most of them are tropical genera which occur chiefly in the North Island of New Zealand but which do not reach the latitude of Tasmania, as, for example, *Avicennia*, *Freycinetia*, *Hedycarya* and *Peperomia*.

The genera which are in New Guinea, Australia, Tasmania and New Caledonia, but which are absent from New Zealand, number 18, of which perhaps the most noteworthy are *Acacia*, *Casuarina*, *Grevillea*, *Hibbertia* and *Xyris*.

There appear to be no genera which occur in New Guinea, New Caledonia, New Zealand and Tasmania, but not on the Australian mainland, the nearest approach perhaps to one being *Astelia*, already mentioned.

Finally it is worthwhile to set out the *difference* between Tasmania and New Zealand in respect of their floristic relations with New Guinea. There are in Tasmania 33 genera which occur also in New Guinea but which are not found in New Zealand, namely :

*Acacia**
Alyxia
Baeckea
Banksia
Caesia
Casuarina
Cryptostylis
Cynoglossum
Desmodium
Dipodium
*Eucalyptus**
Gompholobium
Grevillea
*Haemodorum**
Halophila
Hemarthria
Hibbertia
Indigofera
Lepturus
Melaleuca
Patersonia
Phragmites
Phyllanthus
Posidonia
Psoralea
*Stylidium**
*Thismia**
Thysanotus
Trachymene
Trochocarpa
Vallisneria
Velleia
Xyris

Of these only the five starred have endemic species (13 in all) in Tasmania.

On the other hand there are in New Zealand 46 genera which are also in New Guinea but which are not found in Tasmania, namely :

*Ackama**
*Alectryon**
(*Aleurites*)
*Ascarina**
Avicennia
*Beilschmiedia**
(*Boehmeria**)
*Bulbophyllum**
Calpidia
(*Canavalia*)
*Carpodetus**
*Cordyline**
*Coriaria**
*Corynocarpus**
*Dysoxylum**
*Elatostema**
Fimbristylis
*Freycinetia**
*Geniostoma**
*Hedycarya**
Hibiscus
(*Homalanthus*)
*Iphigenia**
Isachne
*Litsea**
*Melicope**
*Meryta**
*Metrosideros**
*Myrtus**
Panicum
*Paratrophis**
Paspalum
Peperomia
*Phrygilanthus**
Piper
Potentilla
*Planchonella**
*Pratia**
*Ripogonum**
*Quintinia**
*Schefflera**
*Sophora**
Sparganium
Tupeia
*Vitex**
*Weinmannia**

Of these the starred genera have endemic species, totalling 66 (10 of them in *Metrosideros*) in New Zealand, while the genera in parentheses occur in the Kermadec Islands but not in New Zealand proper.

SUMMARY

1. The Angiosperm flora of New Guinea, as at present known, consists of about 1,350 native genera, comprising rather more than 9,000 species in all, of which nearly 8,500, or 90 per cent, are reckoned to be endemic.

2. These genera belong to 200 families, which include all the largest of the Old World except the *Labiatae* and *Amaranthaceae*, all the species of which are under suspicion of being introduced.

3. No families are endemic to, but some are, *for their size and distribution*, especially characteristic of, and well represented in, New Guinea. These include *Araliaceae, Cunoniaceae, Elaeocarpaceae, Icacinaceae* and *Winteraceae.*

4. Indigenous, and especially endemic, species are proportionately very few in *Compositae, Cyperaceae, Gramineae* and *Leguminosae,* as well as in several small families.

5. The family *Orchidaceae,* on the other hand, with over 2,600 species, has four times as many as the next family, the *Rubiaceae,* which in turn has more than twice the number in *Myrtaceae* and *Palmae* which come next. Virtually all the orchid species are endemic.

6. About 500, or 37 per cent, of the genera, containing about 3,650, or 42 per cent, of the endemic species, have palaeotropical, *or wider,* distributions.

7. About the same number of genera (500), containing almost the same number of endemic species, are Indomalaysian in distribution. Directionally these may be thought of as the western and northern element in the flora.

8. The corresponding Pacific, or eastern, element in the flora contains 126, or 9 per cent, of the genera, with 538, or 6 per cent, of the endemic species.

9. The corresponding Australian, or southern, element in the flora contains 62, or 4.5 per cent, of the genera, with 64, or considerably less than 1 per cent, of the endemic species.

10. A detailed review of these 62 genera suggests that this element of the flora is of even less general consequence than these actual numbers suggest.

11. The endemic genera of the New Guinea flora number 141, or about 10 per cent of the total, but these contain only about 350 species or 4 per cent of the endemics.

12. Table II on p. 222 shows the prevalence of these geographical types in all the families represented in the flora by more than a dozen genera. It cannot usefully be summarized but careful scrutiny of it will reveal many interesting points.

13. Nearly 700 (more than 50 per cent) of the genera indigenous to New Guinea are found also in Australia. 385, or about 28 per cent, of the genera indigenous to New Guinea are found also in New Caledonia.

14. 165, or about 13 per cent, of the genera indigenous to New Guinea are found also in New Zealand, a notable proportion bearing in mind the distance apart and difference in latitude of the two. This relationship is amplified by various other more detailed items.

ACKNOWLEDGMENTS

It is a great pleasure to acknowledge the help of Mr. J. S. Womersley, not only for his guidance in New Guinea, but also for allowing me to make use so generously of his wide knowledge of the island and its vegetation.

Much of the work has been done in the Department of Botany, British Museum (Natural History), and to Mr. J. E. Dandy, Keeper of Botany, I am indebted not only for freely putting at my disposal the collections and library in his charge, but for more personal advice on various matters of detail.

I am grateful also to many other friends for their help with particular groups or topics and especially to Dr. S. T. Blake, Dr. C. E. Hubbard, Mr. L. A. S. Johnson, Dr. H. E. Moore, jr., Mr. J. Sinclair, Dr. H. Sleumer, Dr. A. C. Smith, Mr. V. S. Summerhayes and Dr. P. van Royen.

BRITISH MUSEUM
22 JUL 1960
NATURAL HISTORY

PRINTED IN GREAT BRITAIN BY
ADLARD AND SON, LIMITED
BARTHOLOMEW PRESS, DORKING

A.
O.

SAXIFRAGA OF THE HIMALAYA

II. SOME NEW SPECIES

HARRY SMITH

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 9
LONDON : 1960

SAXIFRAGA OF THE HIMALAYA

II. SOME NEW SPECIES

BY

HARRY SMITH

(Uppsala)

BRITISH MUSEUM NATURAL HISTORY

Pp. 227–260 ; 17 *Text-figures* ; *Plates* 13–21

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 9
LONDON : 1960

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 9 of the Botany series.

© Trustees of the British Museum, 1960

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued November, 1960 *Price Twenty-one Shillings*

SAXIFRAGA OF THE HIMALAYA

II. SOME NEW SPECIES

By HARRY SMITH

IN the first of these papers[1] an account was given of the Himalayan species of *Saxifraga* sect. *Kabschia,* a group so well represented in the Himalaya that the description of more than 30 new species was involved. The present paper adds 27 new species of *Saxifraga* belonging to other sections of the genus but mostly to Sect. *Hirculus.* Four of the new species are from the extreme north of Burma to the east of the main Himalaya; the others are from the region of the eastern Himalaya including Nepal, Sikkim, Bhutan and south-eastern Tibet. Varieties of three other species are also described. Unless otherwise indicated, the specimens cited are in the herbarium of the Department of Botany, British Museum (Natural History), and my sincere thanks are due to the Keeper of Botany for the loan of this rich material obtained on recent expeditions to the Himalaya and adjoining regions.

Sect. MICRANTHES (Haw.) D. Don (Sect. *Boraphila* Engler)

Grex MELANOCENTRAE Engler & Irmscher

Saxifraga rubriflora H. Sm., sp. nov. (Plate 13 A.)

Planta ex affinitate *S. gageanae* W. W. Sm. et eae flore persimilis, foliis autem valde diversa. Rosulae humiles aggregatae; flores rubri, breviter pedicellati, pro rosula singuli.

Folia rosularia dense conferta, crassiuscula, late obcuneata, c. 7 mm. longa et lata, parte apicali rotundato-truncata crenulato-dentata, parte inferiore integra cuneatim angustata vix petiolata, supra in margine et interdum etiam subtus pilis longis subglanduliferis obsita. *Flores* solitarii, 2–7 mm. longe pedicellati, pedicello rubro crispulo-piloso. *Hypanthium* late obconicum, 1·5 mm. altum. *Sepala* rubescentia, ovata, obtusa, 2·5 mm. longa, 1·5 mm. lata, glabra, nervis 3, lateralibus saepe ramosis in apicem confluentibus. *Petala* rubra, ovato-elliptica, brevissime unguiculata, obtusa, 2·5 mm. longa, 1·5 mm. lata, obscure 3-nervia. *Stamina* 1·5 mm. longa, antherae thecis subrotundatis 0·3 mm. longis. *Ovarium* crassum, ovoideo-conicum, 2 mm. altum, 3 mm. latum, stigmatibus subapplanatis fere sessilibus. *Capsula* adhuc non visa.

BHUTAN: Omta Tso, 4,650 m.; on earthy hill slopes; calyx and corolla port-wine red; filaments red, anthers dark brown; ovaries red; 11 Aug. 1949, *Ludlow, Sherriff & Hicks 17099* (holotype in Herb. Brit. Mus.).

---

[1] Bull. Brit. Mus. (Nat. Hist.), Bot. ii: 83–129 (1958).

Sect. HIRCULUS (Haw.) Tausch

Grex CINCTAE H. Sm.[1]

Saxifraga excellens H. Sm., sp. nov. (Fig. 1; Plate 13 B.)

Planta mirabilis cum nulla alia specie *Saxifragae* bene comparanda. Caules floriferi e rhizomate compacto solitarii vel plures; folia basalia vulgo desunt, folia caulina 3–8, permagna, subtus rubra; flores rubri vel rubescentes, 0·8–1·4 cm. longi, in ramis axillaribus et in apice subumbellatim dispositi.

Caulis infima parte glabrescens, medio laxe, sursum densius pilosus, pilis longis crispulis rubescentibus eglandulosis vel in pedicellis glandula perminuta instructis. *Folia* basalia (si interdum adsint ut in *S., S. & W. 4384, Dhwoj 166*) caulinis infimis similia sed minora; folia caulina infima 1–3, 1–7 cm. longe petiolata, lamina obovato-elliptica ad 9·5 cm. longa et 5·3 cm. lata; folia caulina media et superiora 2–6, amplectenter sessilia, late elliptica, ad 7 cm. longa et 5 cm. lata, supremis in bracteas foliaceas decrescentibus; folia omnia in margine et subtus in nervis atque in petiolo pilis longis crispulis rubescentibus instructa. *Hypanthium* latum, pilis tenuibus minute glanduliferis vel eglandulosis sparsissime obsitum. *Sepala* late ovata, obtusa, 4·5 mm. longa, 3·5 mm. lata, dorso glabra, margine basin versus parce glanduloso-pilosa vel glabrescentia, apice interdum minutissime laciniata, nervis 5 liberis rectis. *Petala* rubra vel rubescentia, obovata, ad basin sensim angustata, ad 9 mm. longa et 6 mm. lata, ecallosa, nervis 5–7. *Stamina* c. 6 mm. longa; filamenta subulata deorsum applanata et basi inter se connata; antherarum thecae rubrae, 1 mm. longae. *Ovarium* superum, ovoideum, fere 5 mm. altum et crassum, stylis robustis vix 1·5 mm. longis, stigmatibus applanatis robustis.

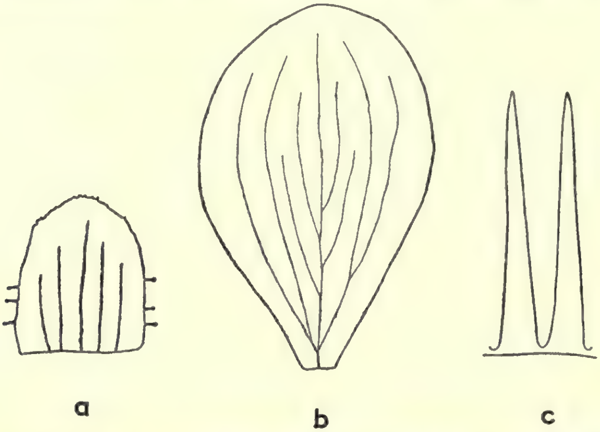


FIG. 1. *Saxifraga excellens* H. Sm. (holotype); *a*, sepal; *b*, petal; *c*, filaments. (All × 5.)

NEPAL: Annapurna Himal, Mardi Khola, 3,750 m.; under overhanging boulders; stem and underside of leaves red; flowers red; 18 Sept. 1954, *Stainton, Sykes &*

---

[1] Grex nov., staminum filamentis basi connatis annulum angustum formantibus distinctus.

Williams 8460 (holotype in Herb. Brit. Mus.). Annapurna Himal, Seti Khola, 4,200 m., 2 Aug. 1954, *Stainton, Sykes & Williams 6596*. Same locality, 4,050 m., 14 Sept. 1954, *Stainton, Sykes & Williams 8615*. Above Sauwala Khola, 3,750 m., 13 Sept. 1954, *Stainton, Sykes & Williams 4384*. Tapchat, 3,900–4,200 m., 1928, *Lall Dhwoj 166*. Foketey, 3,600–4,200 m., 1930, *Lall Dhwoj 0528*.

This remarkable species has an appearance unlike that of any other Saxifraga. The characteristic of having the filaments united at the base has not previously been recorded for the genus, but in other respects the flowers conform to the pattern of Sect. *Hirculus*. I therefore place the species in that section (though with some hesitation) and treat it as the type of a distinct grex.

Grex HIRCULOIDEAE Engler & Irmscher (incl. Greges *Turfosae* Engler & Irmscher, *Stellariifoliae* Engler & Irmscher, *Densifoliatae* Engler & Irmscher)

Saxifraga implicans H. Sm., sp. nov. (Fig. 2 *a–c* ; Plate 14 A.)

Planta cum *S. diversifolia* Wall. ex Ser. sensu latissimo apud Engler et Irmscher in Engler, Pflanzenr. IV. 117 : 127 (1916) confusa. Habitu *S. parnassifoliae* D. Don persimilis sed distat inter alia sepalorum nervis liberis (nec confluentibus), petalis ecallosis (nec elevato-callosis), ovario fere supero (nec semi-infero).

Caulis erectus saepe subflexuosus, 20–50 cm. altus, 10–16-foliatus, inferiore parte modice ferrugineo-pilosus dein glabrescens, superne in ramis floriferis et in pedicellis dense breviter glanduloso-pilosa, pilis paullo inaequalibus 0·1–0·4 mm. longis. *Folia* rosularia vulgo deficientia, si adsint eis caulinibus infimis conformia et subaequimagna ; folia caulina infima ad 4 cm. longe petiolata, lamina cordato-ovata c. 2·5 cm. longa et 1·5 cm. lata, petiolis sursum decrescentibus ; folia caulina media et superiora stricte sessilia, gradatim minora et ovata sed sub inflorescentiam lanceolata ; infima subtus et in margine parce longepilosa supra glabra, media glabra vel glabrescentia, superiora in margine (suprema etiam supra) dense breviglandulosa. *Flores* ad 12 in ramis 4–5 prolongatis et 1–3-floribus subfastigiatim dispositi. *Sepala* longiuscule ovata, in anthesi reflexa, 4 mm. longa, 1·7 mm. lata, superiore parte membranaceo-marginata, dorso margineque glanduloso-pilosa, nervis 3 liberis. *Petala* lutea, intus minute aurantiaco-maculata, ovato-elliptica, in unguem 0·8 mm. longum abrupte contracta, ad 8 mm. longa et 4 mm. lata, ecallosa, 3-nervia. *Stamina* petalis parum breviora. *Ovarium* fere superum, ovoideum, stylis erectis c. 1 mm. longis.

S.E. TIBET : Zimsati, near Sanga Chöling, 4,200 m., 14 Aug. 1936, *Ludlow & Sherriff 2061*. Kongbo, Pangkar, Drukla Chu, 3,450 m., 21 Aug. 1938, *Ludlow, Sherriff & Taylor 6875*. Kongbo, Doré, Nye Chu, 3,900 m., 6 Aug. 1947, *Ludlow, Sherriff & Elliot 15570*. Kongbo, Nyoto Sama, 3,900 m. ; in open forest among rocks ; calyx green ; corolla deep yellow ; filaments and anthers yellow ; 10 Aug. 1947, *Ludlow, Sherriff & Elliot 15582* (holotype in Herb. Brit. Mus.). Shugden Gompa, Nagong River, 3,600–3,900 m., 26 Aug. 1933, *Kingdon-Ward 10791*. Tsarong, upper Salween River, northern slopes of Mt. Kenichunpo, north of Sikitung, 3,750 m., May–June 1932, *Rock 22144*.

CHINA: N.W. Yunnan, Doker La, 3,300–3,600 m., Aug. 1913, *Kingdon-Ward 1042* (Herb. Edinburgh). Same locality, 4,500 m. (?), 20 Oct. 1913, *Kingdon-Ward 1135* (Herb. Edinburgh).

The plant deserves an epithet derived from *implicare* (to entangle), for it is probably this species that has brought about so much misunderstanding of the *S. diversifolia* group. It unites the appearance of *S. parnassifolia* D. Don (Fig. 2 *d–g*) with several

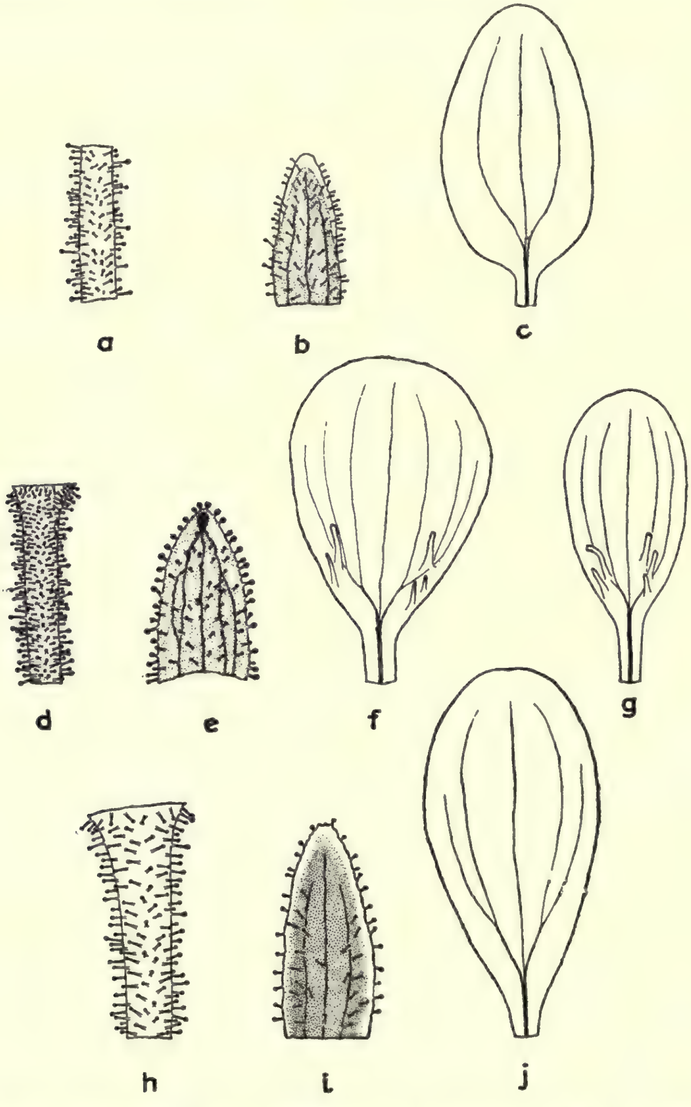


FIG. 2. *Saxifraga implicans* H. Sm. (holotype): *a*, pedicel; *b*, sepal; *c*, petal. *S. parnassifolia* D. Don (*Lall Dhwoj 0260*, except *g*): *d*, pedicel; *e*, sepal; *f*, petal; *g*, petal (type coll.). *S. diversifolia* Wall. ex Ser. (*Ludlow, Sherriff & Taylor 6639*): *h*, pedicel; *i*, sepal; *j*, petal. (All × 5.)

characteristics belonging to *S. diversifolia* Wall. ex Ser. (Fig. 2 *h–j*) and related species.

Saxifraga tigrina H. Sm., sp. nov. (Fig. 3 *a–c* ; Plate 14 B.)

Perennis, solitaria, habitu *S. pardanthinae* Hand.-Mazz. (Fig. 3 *f–h*) similis, sed distat inter alia petalorum forma.

Caulis florifer 12–34 cm. altus, inferiore parte pilis longis ferrugineis instructus, superne et in inflorescentia breviter (0·3 mm.) nigro-glanduloso-pilosus, corymboso-paniculate 4–30-florus. *Folia* rosularia 4–8 ut caulina infima longipetiolata, subtus et in margine longe seriato-ciliata, lamina c. 4 cm. longa et 3 cm. lata ovata ad elliptica basi in petiolum latum lamina sublongiorem cuneatim vel truncatim contracta ; folia caulina 4–8, sursum decrescentia et in bracteas inflorescentiae transeuntia, a medio caulis sessilia, elliptica vel lanceolata, margine seriato-ciliata ; bracteae supremae sparse glanduloso-pilosae. *Calyx* fere ad basin partitus ; sepala ovata, in anthesi reflexa, ad 3 mm. longa et fere 2 mm. lata, utrinque glabra, margine membranacea glanduloso-pilosa, nervis 3 liberis parallelis. *Petala* lutea, inferiore parte maculis brunneo-rubris transverse striata, elliptica, in unguem angustum 2 mm. longum contracta, ad 10 mm. longa et 4·5 mm. lata, lamina deorsum callis elevatis 3–5 instructa. *Stamina* petalis $\frac{1}{3}$ breviora, antherae thecis rubris. *Ovarium* globoso-ovoideum, stigmatibus fere sessilibus. *Capsula* matura adhuc non visa.

S.E. TIBET : Kongbo, Yumbu, 3,000 m. ; on rocks ; calyx green ; corolla bright yellow with maroon markings at base of petals ; 28 Sept. 1947, *Ludlow, Sherriff & Elliot 15805* (holotype in Herb. Brit. Mus.).

Saxifraga calopetala H. Sm., sp. nov. (Fig. 3 *d, e* ; Plate 15 A.)

Planta ad 36 cm. alta, habitu *S. subaequifoliatae* Irmscher (Fig. 3 *i–k*) et flore *S. tigrinae* H. Sm. similis ; ab hac distat foliis infimis in petiolum cuneatim (nec cordatim) contractis, petalis graciliter 2 mm. longe unguiculatis inferiore dimidia parte brunneo-rubro-punctulatis (nec ungue robusto 0·5 mm. longo et petalis in toto punctulatis) ; ab illa, foliis caulinis numerosioribus majoribus, supremis pilis glanduliferis dense obsitis, sepalis fere duplo majoribus dorso margineque longe glanduloso-pilosis, ovario minore.

Caules floriferi solitarii (?), infima parte longe et dense ferrugineo-pilosi, superne et in ramis floriferis et in pedicellis copiose glanduloso-pilosi ; inflorescentia 9–14-flora, elongato-cymosa. *Folia* basalia longipetiolata, emarcida ; folia caulina 8–13, omnia apice acuta vel subacuta, infima 6–8 cm. longa, lamina lanceolata 2–3 cm. lata in petiolum ad 3 cm. longum sensim angustata, margine et petiolo ferrugineo-pilosa, ceterum glabrescentia ; media breviter petiolata vel subsessilia, lamina ad 4·5 cm. longa et 2·8 cm. lata in basin cuneatim angustata ; superiora sessilia, ovato-elliptica, decrescentia et in bracteas lanceolatas transeuntia ; folia media supra sparse, suprema dense ferrugineo-pilosa, bracteis etiam pilis longis glanduliferis obsitis. *Hypanthium* glanduloso-pilosum. *Sepala* lineari-ovata, ad 5 mm. longa et 2 mm. lata, dorso margineque longe glanduloso-pilosa, nervis 3 vulgo sub apice in verruculam confluentibus. *Petala* aurantiaca, infima dimidia parte brunneo-rubro-punctulata, elliptica, in unguem gracilem 2 mm. longum contracta, c. 8 mm. longa et 4 mm. lata. *Stamina* petalis $\frac{1}{4}$ breviora, antherae thecis rubris. *Ovarium* superum, anguste ovoideum, statu submaturo 4 mm. longum et 2·5 mm. crassum, stylis aetate divaricantibus vix 1 mm. longis.

BURMA: Nam Tamai valley (Adung Wang–Gamlang Wang), 28° 15′ N., 97° 30′ E., 3,000–3,300 m.; in open places; whole plant hairy with long cottony hairs, shorter

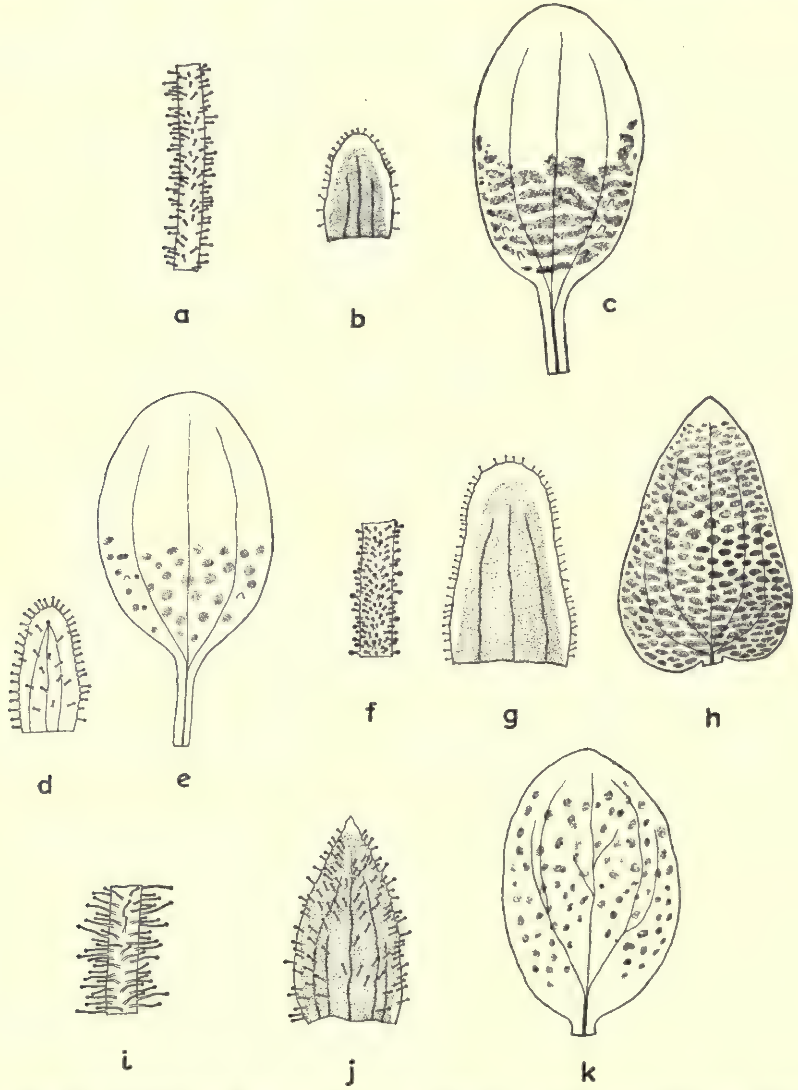


FIG. 3. *Saxifraga tigrina* H. Sm. (holotype): *a*, pedicel; *b*, sepal; *c*, petal. *S. calopetala* H. Sm. (holotype): *d*, sepal; *e*, petal. *S. pardanthina* Hand.-Mazz. (*Kingdon-Ward 4904*, paratype coll. of *S. atrosanguinea* Anthony): *f*, pedicel; *g*, sepal; *h*, petal. *S. subaequifoliata* Irmscher (holotype): *i*, pedicel; *j*, sepal; *k*, petal. (All × 5.)

and gland-tipped on the inflorescence-pedicels, bracts and calyx; flowers orange with a disk of small maroon spots in the centre; 30 Sept. 1937, *Kingdon-Ward 13321* (holotype in Herb. Brit. Mus.).

Saxifraga sphaeradena H. Sm., sp. nov.

Planta verisimiliter ex affinitate *S. subamplexicaulis* Engler & Irmscher. Perennis; caules erecti, solitarii vel plures conferti, 6–15 cm. alti, uniflori; flores subdioici, lutei, 18–23 mm. diam.

Subsp. **sphaeradena.** (Fig. 4 *a–d*; Plate 15 B.)

Caules solitarii vel 2–3 conferti, 12–15 cm. alti, 6–8-foliati, deorsum glabri, suprema parte sub florem glandulis robustis rubro-nigris sessilibus vel interdum perbreviter stipitatis ornati. *Folia* omnia glabra; folia rosularia tenuiter 2–3 cm. longe petiolata, lamina triangulari-ovata patenter curvata 10–12 mm. longa et c. 7 mm. lata; folia caulina sursum decrescentia, infima 2–3 breviter petiolata longiuscule triangularia ad 15 mm. longa et 5 mm. lata, superiora fere recte patentia stricte sessilia basi lata caulem amplectantia, suprema 6 mm. longa. *Sepala* late ovata, 4 mm. longa, 3 mm. lata, glabra, nervis 3 in apicem confluentibus. *Petala* lutea, aurantiaco-maculata, rotundato-elliptica, vix unguiculata, 8–10 mm. longa, 5·5–7 mm. lata, ecallosa, 5-nervia. *Stamina* in flore submasculo petalis duplo breviora, antherae thecis luteis subglobosis c. 0·7 mm. longis pollen producentibus. *Ovarium* in flore submasculo verisimiliter abortivum, globosum, c. 4 mm. altum, stylis minutis, stigmatibus imperfectis.

NEPAL: Ganesh Himal, Shiar Khola, 3,750 m., 15 July 1953, *Gardner 1311*. Same locality, 4,050 m., 15 July 1953, *Gardner 1340*. Langtang valley, c. 4,950 m., June 1949, *Polunin 637*. Central Nepal, without precise locality, 4,800 m., 1949, *Tilman* for *Polunin 1691*. Arun-Tamur watershed, south of Topke Gola, 4,200 m., 8 July 1956, *Stainton 884*. Tamur valley, Mewa Khola, Topke Gola, 4,050 m., 12 July 1956, *Stainton 956*.

SIKKIM: Lampokri, 4,200 m., 12 Aug. 1913, *Rohmoo Lepcha 890* (Herb. Edinburgh).

S.E. TIBET: Lukuthang, Mago, 4,050 m.; in masses on rocks and also on stony hill slopes; colour yellow; 3 Aug. 1934, *Ludlow & Sherriff 807* (holotype in Herb. Brit. Mus.).

I have chosen *Ludlow & Sherriff 807* as type. This good and well-preserved material will give a better representation of the species than the rather poor *Rohmoo Lepcha 890*, though there also two subfemale individuals are present. On these the following description is based:

Planta (*Rohmoo Lepcha 890*) subfeminea etiam si habitu minor tamen typo conformis. Stamina c. 3 mm. longa, antherae thecis minutis polline carentibus. Ovarium crassum, ovoideo-globosum, stylis robustis divaricatis 1 mm. longis, stigmatibus applanatis.

Polunin 637 (submale) and *1691* (subfemale) are slightly divergent from the type. The leaves are more narrow, the petals bicallose and the anthers reddish-brown. They might represent a variety of their own.

Subsp. **dhwojii** H. Sm., subsp. nov. (Fig. 4 *e–h*.)

Planta (submascula solum visa) densiuscule caespitosa ; caules plures, 6–8 cm. alti, 3–5-foliati, infima parte glabri vel sparsissime rufo-pilosi, sursum sat dense glanduloso-pilosi, glandulis nigris inaequimagnis media parte caulis breviter stipitatis, superne partim subsessilibus. *Folia* rosularia et saepe caulina infima margine et in pagina superiore robuste albo-ciliata ; folia caulina suprema glabra vel margine glandulis sessilibus ornata. *Sepala* elongate triangulari-ovata, obtusa vel acuta et

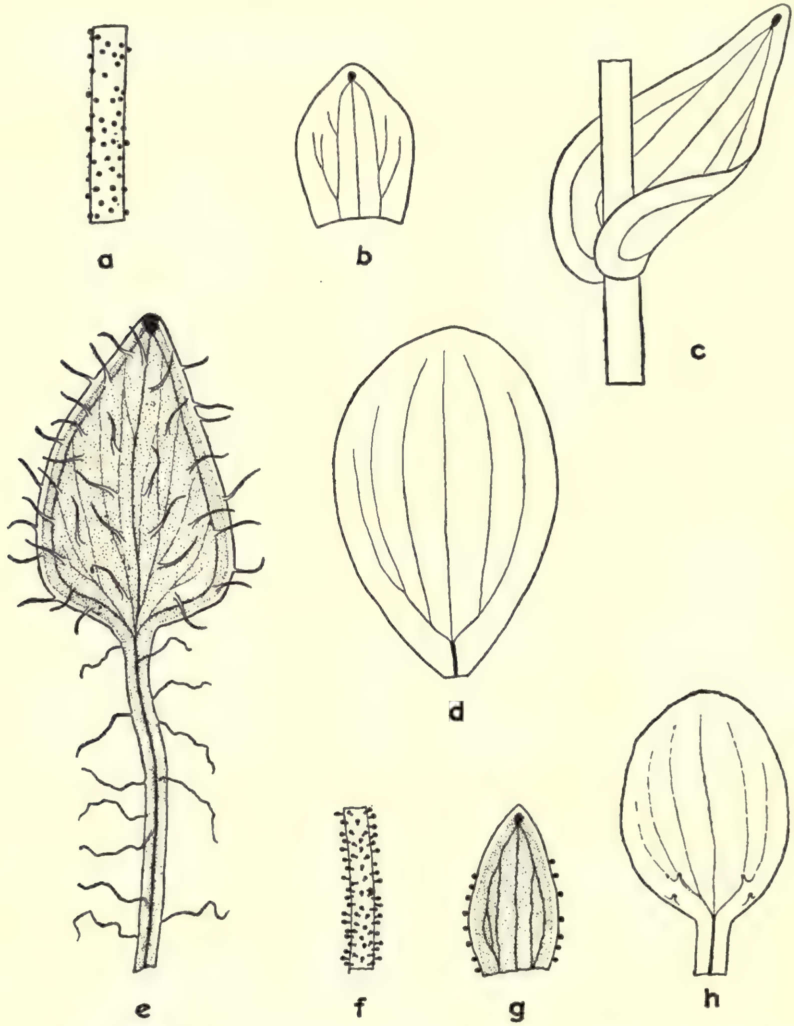


FIG. 4. *Saxifraga sphaeradena* H. Sm. subsp. *sphaeradena* (holotype) : *a*, pedicel ; *b*, sepal ; *c*, cauline leaf, n. 3 from top ; *d*, petal. *S. sphaeradena* subsp. *dhwojii* H. Sm. (holotype) : *e*, rosular leaf ; *f*, pedicel ; *g*, sepal ; *h*, petal. (All × 5.)

saepe recurvantia, 4 mm. longa, 2 mm. lata, margine parce sessili-glandulosa. *Petala* lutea, in unguem distinctum 1 mm. vel ultra longum contracta, elevatim 2- vel 4-callosa.

NEPAL: Jata Pokhni, 4,200–4,500 m.; flowers yellow; 1930, *Lall Dhwoj 0625* (holotype in Herb. Brit. Mus.).

SAXIFRAGA MONTANA H. Sm. in Act. Hort. Gothoburg. i: 9, fig. 2 *e–l*, t. 6 (1924).

Forma **rubra** H. Sm., forma nov.

Flores paullo minores, petalis rubris 6–8 mm. longis. Ceterum a typo speciei non diversa.

NEPAL: Namdo, north of Mustang, 4,950 m.; on wet boggy grassland; calyx, corolla and filaments red, anthers yellow; 9 Aug. 1954, *Stainton, Sykes & Williams 2336* (holotype in Herb. Brit. Mus.).

Saxifraga namdoensis H. Sm., sp. nov. (Fig. 5; Plate 16 A.)

Species ex affinitate *S. congestiflorae* Engler & Irmscher, habitu *S. hookeri* Engler & Irmscher subsimilis; ab hac distat planta non caespitosa, foliis caulinis paucioribus sursum decrescentibus, sepalorum nervis sub apice confluentibus, stylis 0·5 mm. longis (nec 1·5 mm.); ab illa, planta omnino eglandulosa, praesertim in pedicellis dense ferrugineo-pilosa (nec glanduloso-pilosa), floribus fere duplo majoribus, sepalis obtusissimus margine ferrugineo-pilosis (nec acutis, glandulosis).

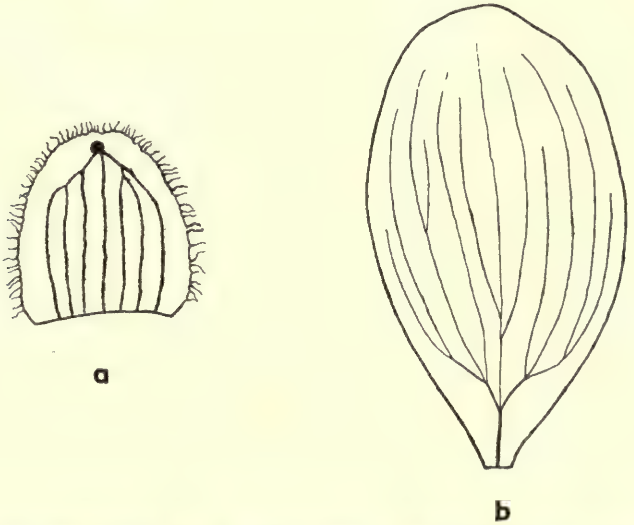


FIG. 5. *Saxifraga namdoensis* H. Sm. (holotype): *a*, sepal; *b*, petal. (Both × 5.)

Caules floriferi solitarii vel pauci conferti, ad 25 cm. alti, superne pauciramosi flores 3–7 gerentes, infima parte glabri, sursum modice et in ramis floriferis densius ferrugineo-pilosi, 6–8-foliati. *Folia* basalia emortua; folia caulina sursum decrescentia, margine et in axillis modice ferrugineo-pilosa, ceterum nitenter glabra, infima 1–2 ad 1 cm. longe petiolata, lamina ad 2·2 cm. longa et 0·9 cm. lata; superiora sessilia, lamina lanceolata 2·8–1·5 cm. longa et 0·9–0·4 cm. lata. *Hypanthium* glabrescens. *Sepala* late ovata, c. 4 mm. longa et 2·7–4·2 mm. lata, dorso glabra, margine crebre albo-ferrugineo-crispulo-pilosa, nervis 5–7 sub apice confluentibus. *Petala* lutea, obovato-elliptica, non unguiculata, ad 11 mm. longa et 7 mm. lata, ecallosa, nervis 9–11 ramosis. *Stamina* c. 5 mm. longa. *Ovarium* fere ⅓ inferum, subglobosum, 6·5 mm. altum, 5 mm. crassum, stylis brevissimis 0·5 mm. longis, stigmatibus robustis 1 mm. diam.

NEPAL: Namdo, north of Mustang, 4,500 m.; on grass bank of stream; stem covered with pink hairs; calyx reddish-green; petals, filaments and anthers yellow; 7 Aug. 1954, *Stainton, Sykes & Williams 2266* (holotype in Herb. Brit. Mus.).

Saxifraga montanella H. Sm., sp. nov. (Fig. 6; Plate 16 B.)

Planta ex affinitate *S. montanae* H. Sm. sed multo minor, caulibusque semper unifloris. Perennis, caespites densas humiles formans, caulibus numerosis 2–5 cm. altis laxe foliatis; flores vulgo subdioici, lutei, c. 11 mm. diam.

Caulis tota longitudine modice sed sub florem densiuscule ferrugineo-pilosus. *Folia* rosularia ad 10 mm. longa, in margine et sparsim etiam in pagina superiore longe ferrugineo-pilosa, pilis non raro glandula brunnea perminuta instructis, lamina lanceolata ad 5 mm. longa et 1·5–2 mm. lata, apice obtusa, basi in petiolum 0·5 mm. latum sensim angustata; folia caulina 6–10, infima subpetiolata ad 10 mm. longa et 1·7 mm. lata, suprema breviora et latiora, omnia in margine longe ferrugineo-pilosa, pilis crispulis interdum minutissime capitulatis. *Hypanthium* basi ferrugineo-pilosum. *Sepala* rotundato-ovata, 3·5 mm. longa, fere 3 mm. lata, dorso glabra, margine ciliata vel glabra, nervis 3–5 liberis. *Petala* lutea, ovata vel orbicularia, in unguem ad 0·8 mm. longum abrupte contracta, 6 mm. longa, 4 mm. lata. *Stamina* in flore submasculo inaequilonga, filamento 2 vel 3·5 mm. longo, antherae thecis pollen producentibus 0·7 mm. longis et crassis; in flore subfemineo c. 3 mm. longa, thecis deminutis polline carentibus. *Ovarium* in flore submasculo cupuliforme, 3·5 mm. altum, stylis brevissimis, stigmatibus non evolutis; in flore subfemineo dimidio fissum, stylis robustis 1 mm. longis, stigmatibus robustis. *Capsula* annotina plantae submasculae semina non producens.

BHUTAN: Narim Thang, 4,050 m.; on dry cliffs; flowers golden yellow; 23 July 1949, *Ludlow, Sherriff & Hicks 21325* (holotype in Herb. Brit. Mus.). Me La, 4,200 m., 6 Aug. 1933, *Ludlow & Sherriff 423*. Me La (south side), 4,200 m., 2 Sept. 1949, *Ludlow, Sherriff & Hicks 21181*. Gaffoo La, Pho Chu-Mangde Chu watershed, 4,800 m., 15 Sept. 1949, *Ludlow, Sherriff & Hicks 17244*. Head of western branch of Pho Chu, 4,050 m., 21 June 1949, *Ludlow, Sherriff & Hicks 16608*. Tolegang, Tsampa, 4,350–4,650 m., 10 Sept. 1949, *Ludlow, Sherriff & Hicks 19720*.

S.E. TIBET: Lukuthang, Mago, 4,050 m., 3 Aug. 1934, *Ludlow & Sherriff 809*. Kongbo, Kulu Phu Chu, near Paka, 29° 15′ N., 94° 25′ E., 4,650 m., 27 July 1938,

Ludlow, Sherriff & Taylor 5968a. Kongbo, Mira La, Nyang Chu, Puchu, 29° 30′ N., 94° 15′ E., 4,500–4,800 m., 14 Aug. 1938, *Ludlow, Sherriff & Taylor 6068.*

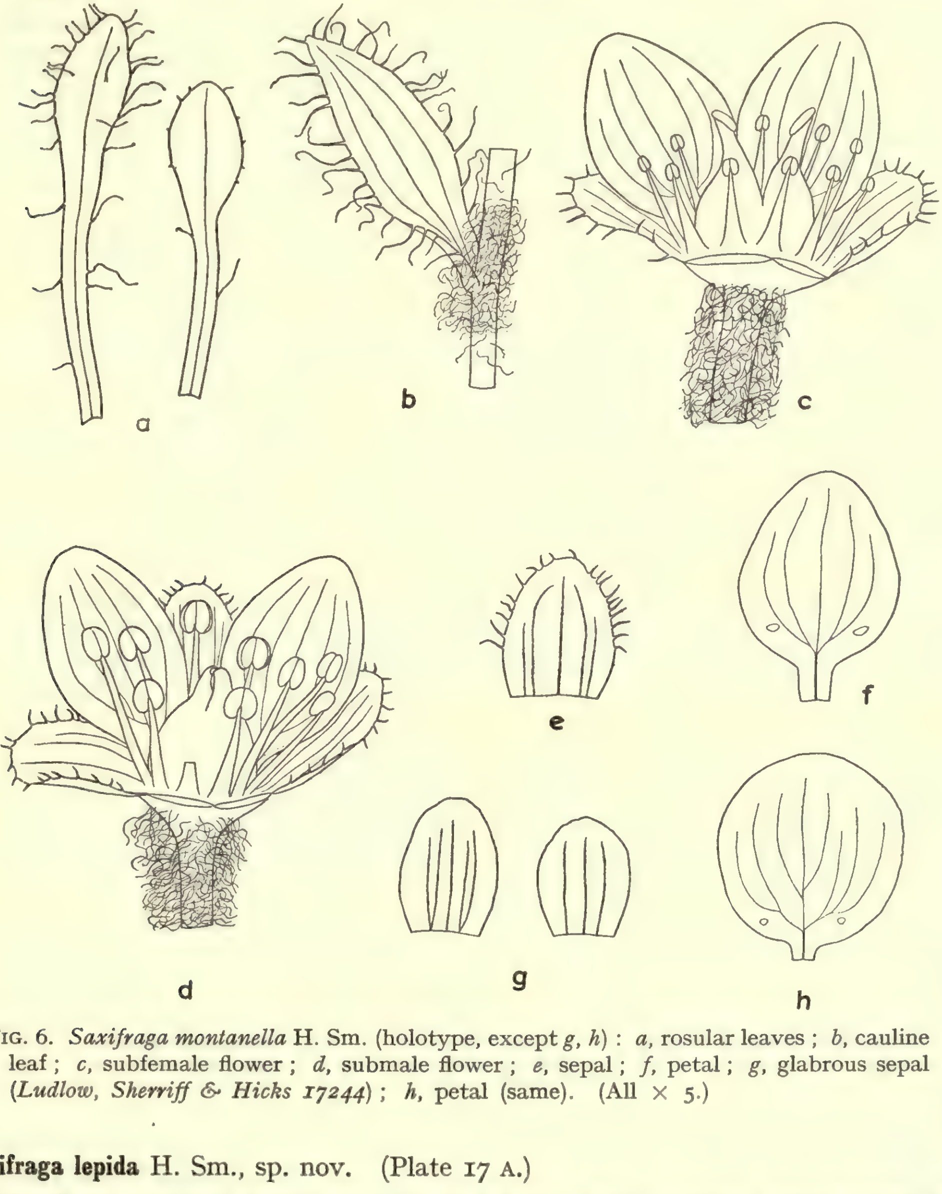


Fig. 6. *Saxifraga montanella* H. Sm. (holotype, except *g*, *h*) : *a*, rosular leaves ; *b*, cauline leaf ; *c*, subfemale flower ; *d*, submale flower ; *e*, sepal ; *f*, petal ; *g*, glabrous sepal (*Ludlow, Sherriff & Hicks 17244*) ; *h*, petal (same). (All × 5.)

Saxifraga lepida H. Sm., sp. nov. (Plate 17 A.)

Caespitosa, caulibus erectis gracillimis 5–8 cm. altis unifloris ; flores vulgo subdioici, lutei, ad 1·3 cm. diam.

Caulis 4–8-foliatus, in axillis parce rufo-pilosus, pilis aetate evanidis, ceterum glaber. *Folia* rosularia 1–1·5 cm. longa, lamina lanceolato-lineari 0·6–2 mm. lata basi in petiolum subaequilongum sensim angustata, glabra vel sparse–densiuscule

ciliata; folia caulina angustissime linearia, attenuato-subsessilia, glabra vel modice ciliata, sursum decrescentia, infima ad 1 cm. longa. *Sepala* elliptica, 2·5 mm. longa, 1·6 mm. lata, initio anthesis patentia, demum reflexa, glabra, margine submembranacea, nervis 3 liberis. *Petala* lutea, intus basi aurantiaco-maculata, rotundato-obovata, brevissime unguiculata, 6 mm. longa, 4 mm. lata, 3–5-nervia. *Stamina* petalis duplo breviora, antherae thecis in flore subfemineo polline carentibus. *Ovarium* in flore submasculo parvum, conicum, stylis deminutis; in flore subfemineo ovoideum, stylis suberectis fere 0·5 mm. longis. *Capsula* matura adhuc non visa.

NEPAL: Tukucha, Kali Gandaki, 3,150 m., 22 Aug. 1954, *Stainton, Sykes & Williams 7396*. Annapurna Himal, Seti Khola, 3,750 m., 3 Aug. 1954, *Stainton, Sykes & Williams 6613*.

BHUTAN: Maruthang, 3,540 m.; in grassy ravines; calyx reflexed, green on exposed inner surface, red on outer surface; corolla yellow; 10 Aug. 1949, *Ludlow, Sherriff & Hicks 17095* (holotype in Herb. Brit. Mus.). Pangotang,Tsampa, 3,750 m., 9 Sept. 1949, *Ludlow, Sherriff & Hicks 19707*.

The rosular leaves are variable as to the ciliation. One specimen may have some leaves glabrous and others ciliate. A whole collection can have them all perfectly glabrous (*L., S. & H. 19707*) or densely ciliate (*S., S. & W. 6613*). The ciliation of the rosular and the lower cauline leaves seems to be of no taxonomic significance.

An incompletely labelled specimen of this elegant plant in Herb. Edinburgh (numbered *174* but without locality) was recognized as a new species by W. W. Smith. The specific name noted by him on the sheet was never published, and has been used later by another author.

Saxifraga lepidostolonosa H. Sm., sp. nov. (Plate 17 B.)

Species ex affinitate *S. lepidae* H. Sm. et eae similis, sed distat planta laxe caespitosa e basi stolones graciles emittenti, caule sursum breviter nigro-glanduloso, floribus hermaphroditis, sepalis non reflexis.

Caulis uniflorus, 4–7-foliatus, in axillis rufo-pilosus, deorsum glaber, sursum glandulis nigris brevistipitatis instructus; stolones tenues, repentes, ad 4 cm. longi, in axillis foliorum tenuium rufo-pilosi. *Folia* rosularia c. 1 cm. longa, basi rufo-pilosa ceterum glabra, lamina lanceolato-lineari 1 mm. vel minus lata, apice obtusa, basi in petiolum subaeqilongum attenuata, pagina supera cellulis magnis convexis nitide subverruculata; folia caulina linearia, attenuato-sessilia, glabra, sursum decrescentia, infima ad 1 cm. longa, minus quam 1 mm. lata. *Sepala* ovato-elliptica, non reflexa, 2 mm. longa, 1·2 mm. lata, glabra. *Petala* lutea, obovata, obscure unguiculata, c. 4·5 mm. longa et 2–2·5 mm. lata, 3-nervia. *Stamina* petalis duplo breviora. *Ovarium* ovoideo-globosum, stylis divaricatis subrobustis 0·6 mm. longis. *Capsula* matura adhuc non visa.

BHUTAN: Jü La, Mangde Chu, 4,200 m.; in damp peaty ground; calyx reddish-brown; corolla yellow; 19 July 1949, *Ludlow, Sherriff & Hicks 16896* (holotype in Herb. Brit. Mus.).

Saxifraga glabricaulis H. Sm., sp. nov. (Fig. 7 ; Plate 18 A.)

Saxifraga palpebrata sensu Sm. & Cave in Rec. Bot. Surv. Ind. iv : 192 (1911) ; non Hook. & Thoms.

Saxifraga palpebrata var. *elliptica* W. W. Sm. in Rec. Bot. Surv. Ind. iv : 368 (1913), *nom. nud.*

Saxifraga palpebrata var. *parceciliata* Engler & Irmscher in Engler, Pflanzenr. IV. 117 : 125 (1916).

Species a *S. palpebrata* Hook. & Thoms. bene distincta caulibus glabris, pilis ferrugineis deficientibus, foliis caulinis petiolatis, sepalis eciliatis, petalis unguiculatis.

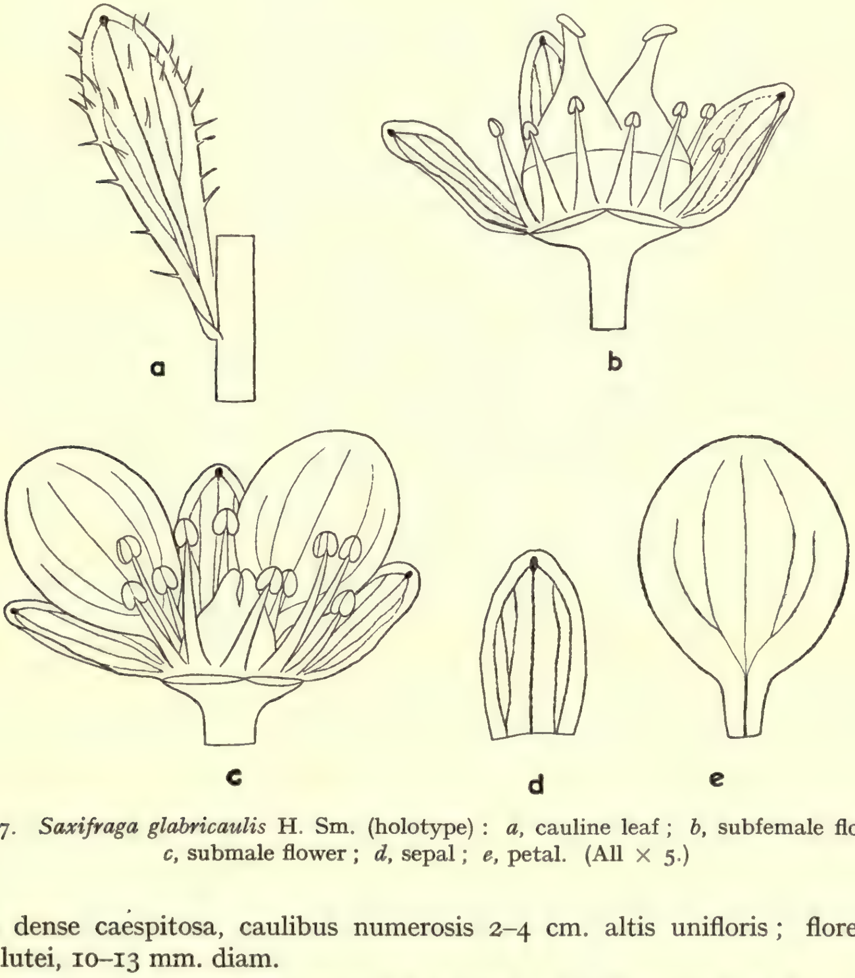


FIG. 7. *Saxifraga glabricaulis* H. Sm. (holotype) : *a*, cauline leaf ; *b*, subfemale flower ; *c*, submale flower ; *d*, sepal ; *e*, petal. (All × 5.)

Planta dense caespitosa, caulibus numerosis 2–4 cm. altis unifloris ; flores subdioici, lutei, 10–13 mm. diam.

Caulis perfecte glaber, densiuscule c. 6-foliatus. *Folia* rosularia ad 2 cm. longa, lamina lanceolato-ovata 4–6 mm. longa et 1·5–3 mm. lata, apice obtusa, basi in petiolum tenuem contracta, supra et in margine robuste ciliata ; folia caulina deorsum longe, sursum breviter petiolata vel interdum basi acuto subsessilia, petiolo basin versus vulgo saccato-subinflato, lamina subaequilonga late oblanceolata

6–8 mm. longa et 2–3 mm. lata, apice obtusa margine et vulgo etiam supra grosse ciliata. *Hypanthium* glabrum. *Sepala* late lanceolata, obtusa, 3–4 mm. longa, 1–3 mm. lata, glabra, nervis 3–5 sub apice in verruculam confluentibus. *Petala* lutea, elliptica vel suborbicularia, in unguem fere 1·5 mm. longum abrupte contracta, ad 8 mm. longa et 5·5 mm. lata. *Stamina* in flore submasculo inaequilonga, filamentis alternatim 2 et 3·5 mm. longis, antherae thecis crassis 0·8 mm. longis pollen producentibus ; in flore subfemineo 2·5 mm. longa, thecis deminutis polline carentibus. *Ovarium* in flore submasculo ovoideo-conicum, c. 2 mm. altum, stylis paullo inflexis vix 0·7 mm. longis, stigmatibus obsoletis ; in flore subfemineo basi annulo lato mellifluo cinctum, c. 3 mm. altum et 4·5 mm. crassum, stylis robustis modice divaricantibus vix 1·5 mm. longis, stigmatibus robustis. *Capsula* annotina in flore submasculo (*L. & S. 3278*) non incrassata.

NEPAL : Chilime Kharka, 4,500 m., July 1949, *Polunin 1260.*

SIKKIM : Kang La, 4,500 m., July 1888, *King's collector* (Herb. Calcutta). Lampokri, 4,200 m., 13 Aug. 1913, *Rohmoo Lepcha 880* (Herb. Edinburgh). Tangu, 4,050 m., 15 Aug. 1909, *Smith & Cave 2568* (syntype of *S. palpebrata* var. *parceciliata* in Herb. Calcutta). Ningbil, 3,690 m., 11 Aug. 1910, *W. W. Smith 4178* (Herb. Calcutta). Above Tosa, 4,500 m., 30 July 1910, *W. W Smith 3986* (syntype of *S. palpebrata* var. *parceciliata* in Herb. Calcutta).

BHUTAN : Chomolhari, 4,800 m., 12 Sept. 1912, *Rohmoo Lepcha 531* (Herb. Edinburgh). Pangotang, Tsampa, 4,500 m. ; mostly in small clumps, on cliff face, together with *Primula umbratilis* ; corolla bright yellow ; 1 July 1949, *Ludlow, Sherriff & Hicks 19305* (holotype in Herb. Brit. Mus.). Shingbe, Me La, 4,500 m., 24 June 1949, *Ludlow, Sherriff & Hicks 20400.* Chesha La, 4,200 m., 27 June 1949, *Ludlow, Sherriff & Hicks 16639.* Chesha La, upper Pho Chu, 4,350 m., 25 Sept. 1949, *Ludlow, Sherriff & Hicks 17284.* Dungshinggang (Black Mountain), 4,500 m., 18 June 1937, *Ludlow & Sherriff 3278.*

S.E. TIBET : Chomolhari, near the snow, 30 July 1882, *King's collector* (Herb. Calcutta). Pele La, 4,800 m., 23 July 1914, *Cooper 1735a* (Herb. Edinburgh).

Saxifraga deminuta H. Sm., sp. nov. (Fig. 8 *a–d.*)

Planta perennis vix 2·5 cm. alta, sublaxe caespitosa, *S. saginoidi* Hook. & Thoms. subsimilis sed foliis indumentoque distincta.

Caulis uniflorus, ad 12 mm. altus, pilis crispulis apice glandula nigra minutissima instructis laxe ornatus, 3–5-foliatus. *Folia* rosularia ad 10 mm. longa, petiolo lamina subbreviore membranaceo-dilatato, margine ciliato vel nudo basin versus fimbriato-dissoluto, lamina anguste ad late lanceolata 1·2–2·6 mm. lata margine et vulgo etiam supra ciliis paucis robustis instructa, ciliis saepe fimbrio brunneo caudatis ; folia caulina lanceolato-linearia, 4–5 mm. longa, pauciciliata, basi fimbriato-ciliata, fimbriis ferrugineis pro parte longis. *Flores* erecti. *Sepala* ovato-lanceolata, subacuta, 3·5–4 mm. longa, 1·5 mm. lata, glabra vel margine ciliis 1–3 instructa, 3-nervia, nervis liberis. *Petala* lutea, obovata, minute emarginata, 4·5 mm. longa, 3 mm. lata, ecallosa. *Stamina* petalis subduplo breviora. *Ovarium* rotundato-conicum, stylis erectis 1 mm. longis. *Capsula* adhuc non visa.

BHUTAN: Me La (south side), 4,320 m.; in scree; flowers yellow; 26 Aug. 1949, *Ludlow, Sherriff & Hicks 21108* (together with *S. matta-viridis* and *S. saginoides*; holotype in Herb. Brit. Mus.).

This is a minute plant somewhat reminiscent of *S. saginoides* Hook. & Thoms., but the leaves and hairiness are very different.

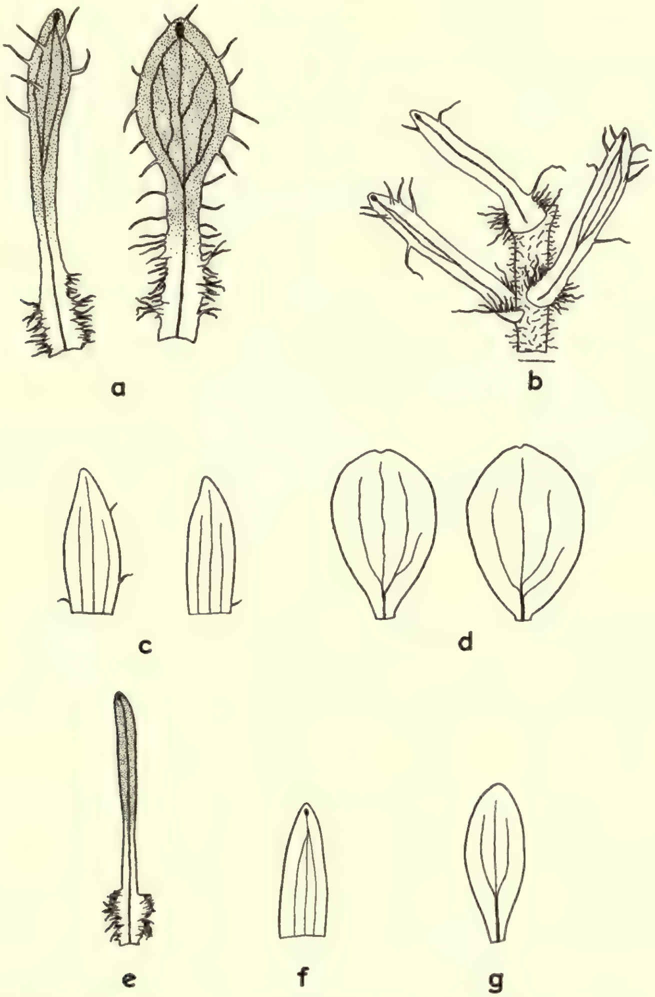


FIG. 8. *Saxifraga deminuta* H. Sm. (holotype): *a*, rosular leaves; *b*, stem with cauline leaves; *c*, sepals; *d*, petals. *S. matta-viridis* H. Sm. (holotype): *e*, rosular leaf; *f*, sepal; *g*, petal. (All × 5.)

Saxifraga matta-viridis H. Sm., sp. nov. (Fig. 8 *e–g*.)

Saxifraga saginoides sensu W. W. Sm. in Rec. Bot. Surv. Ind. iv: 368 (1913) pro parte; non Hook. & Thoms.—Engler & Irmscher in Engler, Pflanzenr. IV. 117: 121 (1916) pro parte.

Saxifraga saginoides var. *parvipetala* Engler & Irmscher, tom. cit.: 122 (1916).

Planta minuta, perennis, subacaulis, caespites densos humiles vivide virides formans, *S. saginoidem* Hook. & Thoms. revocans sed omnino glabra.

Caulis uniflorus, 3 mm. longus, 2–3-foliatus. *Folia* rosularia numerosa, 6–7 mm. longa, petiolo margine membranaceo in parte caulem amplectenti dilatato et fimbriatim dissoluto, lamina carnosa subcylindrica 0·5 mm. diam. basi in petiolum subbreviorem sensim transeunti; folia caulina eis rosularibus similia sed modice latiora. *Flores* erecti. *Sepala* lanceolata vel ovato-lanceolata, subacuta, 3·5 mm. longa, 1·2 mm. lata, nervis 3 anastomosantibus. *Petala* lutea, anguste obovata, 4·2 mm. longa, 1·6 mm. lata, ecallosa, 3-nervia. *Stamina* vix 2 mm. longa. *Ovarium* subconicum, stylis 0·5 mm. longis. *Capsula* adhuc non visa.

SIKKIM: Menentong, 3,900 m., 10 Sept. 1892, *Gammie* (Herb. Calcutta). West of Tanka La, 4,200 m., 11 Aug. 1910, *W. W. Smith 4221* (Herb. Calcutta). Above Tosa, 4,500 m., 30 July 1910, *W. W. Smith 3982* (syntype of *S. saginoides* var. *parvipetala* in Herb. Calcutta).

BHUTAN: Narimthang, 4,200 m.; on open hillside amidst sand and grass; flowers yellow; 26 July 1949, *Ludlow, Sherriff & Hicks 21352* (holotype in Herb. Brit. Mus.). Me La (south side), 4,320 m., 26 Aug. 1949, *Ludlow, Sherriff & Hicks 21108a* (together with *S. deminuta* and *S. saginoides*).

This is the smallest species of the section, forming moss-like, vividly green mats hardly more than 1 cm. high. It is reminiscent of *S. saginoides* Hook. & Thoms., but much smaller, and is distinguished by the total absence of hairs and by the weak fleshy structure of the subcylindric leaves. The leaves of *S. saginoides* are flat, hard and shiny.

Saxifraga heteroclada H. Sm., sp. nov.

Species verisimiliter ex affinitate *S. quadricallosae* Hand.-Mazz. et *S. virgularis* H. Sm. Planta laxe caespitosa; rosulae parvae, et caudiculos bulbilliferos cauliformes breves vulgo erectos et caulem 1–2-florum 9–12 cm. altum edentes.

Var. **heteroclada.** (Fig. 9; Plate 18 B.)

Caudiculi bulbiferi, 2–3 cm. longi, 6–10-foliati, apice et in axillis foliorum bulbillis ellipsoideis parvifoliatis c. 5 instructis, eo apicali majore, axillaribus c. 2 mm. longis, foliis parvis basi dilatato gemmam amplectentibus; caulis florifer in axillis foliorum inferiorum pilis ferrugineis sparsissime instructus, ceterum glaber, 25–40-foliatus; pedicelli 1–2 cm. longi, sparse glanduloso-pilosi. *Folia* rosularia subdense conferta cum pilis longis ferrugineis intermixta, pro statura plantae perparva, 6–9 mm. longa, lamina anguste elliptica, 3 mm. longa et 1 mm. lata, apice obtusa, basi in petiolum c. 0·8 mm. latum alatum margine fusco-pilosum attenuata, supra pilis paucis ferrugineis obsita; folia caulina subaequimagna, subaequaliter disposita, angustissime lanceolato-linearia, plus minusve conduplicantia, subarcuatim patentia, suprema pauca margine sparse glanduloso-pilosa ceterum glaberrima 6–10 mm. longa et 0·75–1·5 mm. lata, infima saepe evanida. *Flores* c. 1·5 cm. diam. *Sepala* late elliptica, obtusa, ad 3 mm. longa et 2 mm. lata, hyalino-marginata, nervis 3 liberis. *Petala* aurea, late elliptica, obsolete unguiculata, ad 7 mm. longa et 4 mm. lata, minute 2–4-callosa, nervis 3–5. *Stamina* petalis $\frac{1}{3}$ breviora. *Ovarium* superum, globoso-conicum, stylis suberectis vix 1 mm. longis.

BURMA : Nam Tamai valley, 28° N., 97° 45′ E., 2,700–3,000 m. ; in clumps on the cliffs within the Conifer-Rhododendron forest ; scape with scattered glandular hairs, otherwise glabrous ; flowers golden yellow, unspotted ; 7 Sept. 1937, *Kingdon-Ward 13152* (holotype in Herb. Brit. Mus.).

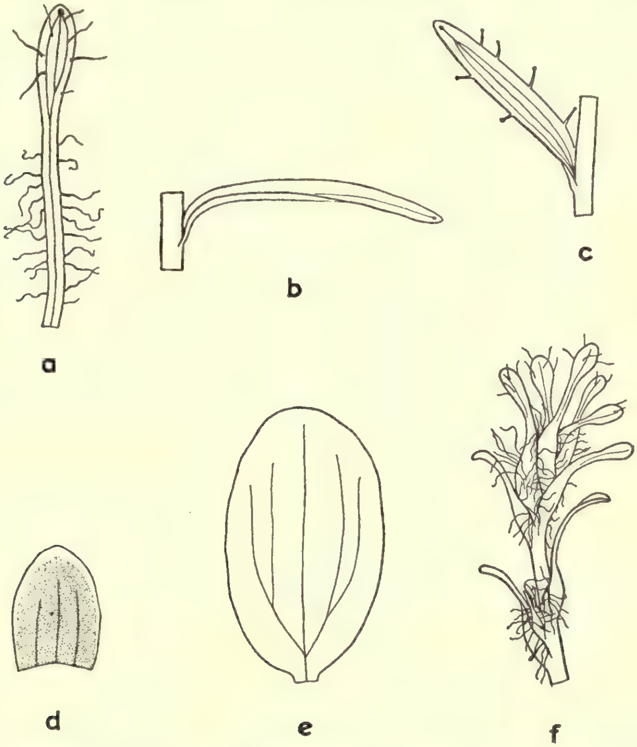


FIG. 9. *Saxifraga heteroclada* H. Sm. var. *heteroclada* (holotype) : *a*, rosular leaf ; *b*, median cauline leaf ; *c*, upper cauline leaf ; *d*, sepal ; *e*, petal ; *f*, top of bulbilliferous shoot. (All × 5.)

Var. **aurantia** H. Sm., var. nov.

A var. *heteroclada* distat foliis caulinis c. 20, 1–2 mm. latis, supremis etiam eglandulosis ; pedicellis glabris ; sepalis margine sparse et minute glanduloso-pilosis ; petalis aurantiacis, obovato-ellipticis, majoribus, 9 mm. longis et 5 mm. latis.

BURMA : Valley of the Seinghku, 28° 8′ N., 97° 25′ E., 3,000–3,300 m. ; on rocks in steep alpine gullies ; flowers orange ; 30 Sept. 1926, *Kingdon-Ward 7521* (holotype in Herb. Kew).

Saxifraga virgularis H. Sm., sp. nov. (Fig. 10.)

Planta ex affinitate *S. quadricallosae* Hand.-Mazz. Rosulae in caespites densos confertae; caules 1- vel 2-flori, numerosi, 7–20 cm. alti, 25–40-foliati, stricti, graciles, ut folia nitenter glabri (floris pedicello glanduloso-piloso excepto), foliis caulinis anguste linearibus subrectis patentibusve subaequimagnis, mediis quam ceteris paullo majoribus, infimis evanidis vel emarcidis.

Folia rosularia ad 1·4 cm. longa, petiolo glabro basi membranaceo-dilatato et pilis longis crispulis nigrescentibus marginato, lamina anguste elliptica ad 4·5 mm. longa et 1 mm. lata supra et in margine pilis longis albescentibus ornata, apice obtusa, basi in petiolum angustum sensim attenuata; folia caulina anguste linearia, ad 8·5 mm. longa et minus quam 1 mm. lata, apice subobtusa, glabra, nitentia, infima et media in axillis pilis paucis longis ferrugineis instructa. *Hypanthium* glabrum. *Sepala* late ovata, obtusa, 2·5–3 mm. longa, 1·7–2·1 mm. lata, dorso glabra, margine breviter glanduloso-pilosa, nervis 3–5 in apicem confluentibus vel partim liberis. *Petala* aurantiaca, rotundato-elliptica, exunguiculata, 6–8 mm. longa, 3–4·7 mm. lata, ecallosa, 5-nervia. *Stamina* petalis subduplo breviora. *Ovarium* superum, globoso-conicum, stylis divaricantibus vix 1 mm. longis.

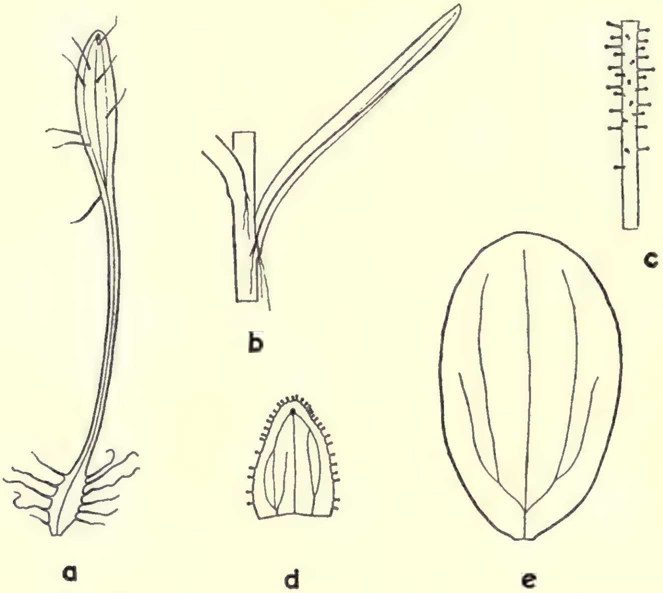


FIG. 10. *Saxifraga virgularis* H. Sm. (holotype): *a*, rosular leaf; *b*, cauline leaf; *c*, pedicel; *d*, sepal; *e*, petal. (All × 5.)

BURMA: Sources of the Irrawaddy, Adung valley, 28° 20′ N., 97° 40′ E., 3,900 m.; in massive clumps on the granite cliffs and turf slopes facing south; basal rosette leaves with long straggling hairs; stems and stem leaves glabrous; peduncles with scattered glandular hairs; flowers bright orange, not spotted; calyx red, fringed with fine glandular hairs ; 22 Aug. 1931, *Kingdon-Ward 9977* (holotype in Herb. Brit. Mus.).

Saxifraga taylorii H. Sm., sp. nov. (Plate 19 A.)

Species ex affinitate *S. turfosae* Engler & Irmscher. Perennis, caespitosa, estolonosa ; caules graciles, vix 10 cm. alti, e basi subdecumbenti arcuatim ascendentes et erecti, subfastigiatim 3–5-flori ; flores lutei, ad 7 mm. longi.

Caulis basi et in axillis modice rufo-pilosus, ceterum glaber. *Folia* rosularia 1·5–2 cm. longe petiolata, lamina late vel anguste lanceolata ad 1·2 cm. longa et 0·3–0·5 cm. lata basi in petiolum sensim contracta, vulgo glabra, interdum supra et in margine parce albo-ciliata ; folia caulina 8–13, sursum decrescentia, infima eis rosulariis subconformia crebra internodiis multo longiora, media sessilia, suprema sparsa internodiis multo breviora lanceolata vel lineari-lanceolata. *Flores* distincte proterandri, 0·5–1·5 cm. longe pedicellati, pedicello glabro vel raro pilis perpaucis minute glandulosis instructo. *Calyx* glaber, fere ad basin partitus ; sepala ovato-elliptica, non reflexa, ad 3 mm. longa et 2 mm. lata, margine submembranacea, nervis 3 liberis. *Petala* lutea, intus aurantiaco-maculata, obovata, fere exunguiculata, obtusa, ad 6 mm. longa et 2·5 mm. lata, media parte diffuse pluricallosa, 3-nervia, nervis lateralibus ramosis. *Stamina* petalis paullo breviora. *Ovarium* ovoideum, stylis divaricatis vix 1 mm. longis, stigmatibus applanatis. *Capsula* matura adhuc non visa.

S.E. TIBET : Kongbo, Mira La, Puchu, 29° 30′ N., 94° 10′ E., 3,900 m. ; on bare gravelly scree bank ; sepals green or flushed reddish-brown ; petals golden-yellow, spotted orange within ; filaments green ; anthers yellow ; carpels green ; 12 Aug. 1938, *Ludlow, Sherriff & Taylor 6124* (holotype in Herb. Brit. Mus.).

Saxifraga isophylla H. Sm., sp. nov. (Fig. 11 ; Plate 19 B.)

Planta *S. auriculatae* Engler & Irmscher affinis et habitu subsimilis, tamen statura graciliore, caule ferrugineo-piloso (nec glanduloso-piloso), foliis (supremis exceptis) petiolatis, lamina basi acuta lanceolata, margine paginisque ferrugineo-pilosa (nec basi lata subsessili, margine paginisque dense et minute glanduloso-pilosa), inter alia distincta.

Caules solitarii (?), basi foliis paucis rosulariis cincti, 16–24 cm. alti, pilis perlongis crispulis ferrugineis modice obsiti, 22–29-foliati ; inflorescentia ad 4·5 cm. longa, 5–15-flora, subumbellatim ramosa, pedicellis floribus sublongioribus pilis tenuibus glanduliferis cum paucis crispulis intermixtis instructis. *Folia* caulina fere aequimagna sursum paullulo decrescentia, infima ad 5 mm. longe petiolata lamina c. 12 mm. longa et 4 mm. lata in petiolum sensim attenuata, media et superiora basi acuta subsessilia vel sessilia lamina margine paginisque longe ferrugineo-pilosa, suprema pauca praeterea margine breviter glanduloso-pilosa. *Flores* distincte proterandri. *Hypanthium* glanduloso-pilosum pilis ferrugineis intermixtis. *Sepala* ovato-lanceolata, subobtusa, c. 4 mm. longa, 2–2·5 mm. lata, dorso margineque glanduloso-pilosa, nervis 3–5 sub apice in verruculam confluentibus. *Petala* aurea, oblongo-linearia, auriculatim in unguem 1 mm. longum perabrupte contracta, obtusa, ad

6·5 mm. longa et 2·5 mm. lata, 3-nervia. *Stamina* petalis duplo breviora. *Ovarium* ⅓ inferum, globoso-conicum, stylis robustis fere 2 mm. longis, stigmatibus magnis applanatis.

S.E. TIBET: Kongbo, Deyang La, 4,050 m.; in clefts of rocks; calyx green; corolla golden-yellow; 11 Aug. 1947, *Ludlow, Sherriff & Elliot 14329* (holotype in Herb. Brit. Mus.).

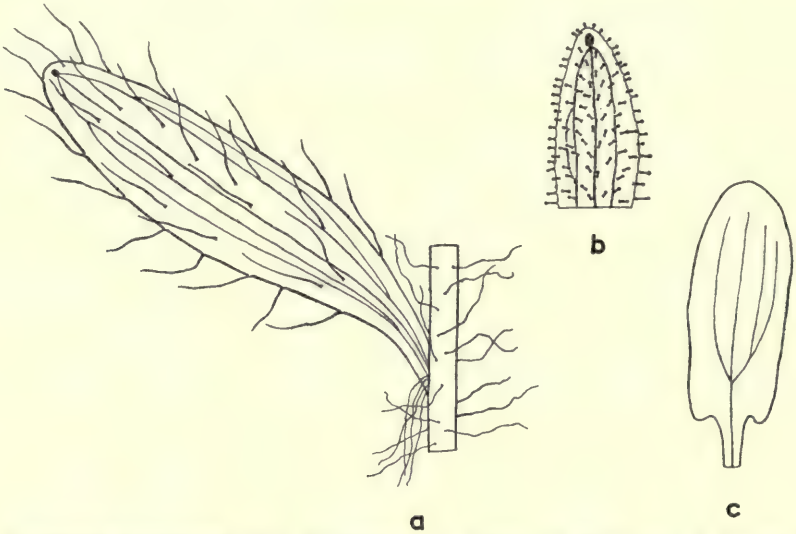


FIG. 11. *Saxifraga isophylla* H. Sm. (holotype): *a*, median cauline leaf; *b*, sepal; *c*, petal. (All × 5.)

Grex NUTANTES Engler & Irmscher

Saxifraga haematochroa H. Sm., sp. nov.

Planta perennis *S. bergenioidi* Marquand affinis, sed statura minore (1–4 cm.), floribus subacaulibus solitariis atrorubris, distincta.

Rosulae singulae (an semper?), e basi innovationes tenues suberectas et florem apicalem subacaulem producentes, a basi subimbricatim foliatae, foliis vetustis mortuis persistentibus; caulis brevissimus, glaber. *Folia* glabra, margine solum parce longipilosa, pilis aetate evanidis; lamina subcoriacea, late lanceolata, ad 8 mm. longa et 4 mm. lata, apice subobtusa, basi in petiolum late alatum margine longipilosum ad 3 mm. longum sensim contracta. *Flores* hermaphroditi, foliis supremis subinvolucrati, c. 7 mm. longi et 10 mm. diam. *Calyx* fere ad basin partitus, glaber; sepala late oblanceolato-obovata, obtusa, c. 5 mm. longa et 3 mm. lata, margine interdum leviter lacerata, nervis 3–5, majoribus sub apice confluentibus. *Petala* atrorubri, rotundato-obovata, 1 mm. longe unguiculata, minute emarginata, ad 7 mm. longa et 4 mm. lata, 5-nervia. *Stamina* ad 5 mm. longa, antherae thecis 0·7 mm. longis. *Ovarium* crassum, ovoideum, stylis distinctis fere 1 mm. longis, stigmatibus applanatis. *Capsula* matura adhuc non visa.

BHUTAN : Me La, 4,500 m., 8 Aug. 1933, *Ludlow & Sherriff 445*.

S.E. TIBET : Kongbo, Mira La, Nyang Chu, Puchu, 29° 30′ N., 94° 15′ E., 4,650 m. ; on large block boulder scree in moss ; sepals dark crimson ; petals deep velvety-crimson ; filaments white, tinged pale crimson ; anthers black ; carpels, styles and stigmas green ; 14 Aug. 1938, *Ludlow, Sherriff & Taylor 6070* (holotype in Herb. Brit. Mus.).

The Bhutan specimens differ from the type in having more marked and, as a rule, persistent ciliation on the margins of the leaves and sepals. Future collections will show if this difference has any taxonomic significance. Probably it falls within the natural variability of the species.

This peculiar plant with blood-red flowers is undoubtedly connected with *S. bergenioides* Marquand, which was regarded by its author as a relation of *S. viscidula* Hook. & Thoms. and *S. lychnitis* Hook. & Thoms. I can see no reason for this view. *S. bergenioides* is in many respects reminiscent of *S. nutans* Hook. & Thoms., and I place it without hesitation together with that species in Grex *Nutantes*. My new species *S. haematochroa* belongs of course to the same group.

Grex GEMMIPARAE Engler & Irmscher

SAXIFRAGA GOULDII C. E. C. Fisch. in Kew Bull. 1939 : 664 (1940).

Var. **eglandulosa** H. Sm., var. nov. (Fig. 12 *a–c* ; Plate 20 A.)

A typo (var. *gouldii*) distat petalis margine eglandulosis, superiore dimidia parte minute laciniatis.

BHUTAN : Tolegang, Tsampa, 4,050–4,200 m. ; common among dwarf Rhododendrons on open steep hillside ; calyx dull deep red ; corolla bright golden ; 10 Sept. 1949, *Ludlow, Sherriff & Hicks 19731* (holotype in Herb. Brit. Mus.). Bumthang Chu, Ju La, 4,200 m., 21 July 1949, *Ludlow, Sherriff & Hicks 16915a*.

S.E. TIBET : Between Me La and Cho La, 4,050 m., 2 1Aug. 1949, *Ludlow, Sherriff & Hicks 21412*. Rip La, Tsari, 4,200 m., 16 Aug. 1936, *Ludlow & Sherriff 2086*. Cha La, 4,050 m., 18 Aug. 1934, *Ludlow & Sherriff 843*.

S. gouldii differs from the closely related *S. wardii* W. W. Sm. (Fig. 12 *d–f*) by the more numerous and more narrow leaves of which only the uppermost have glands on some of the marginal spinules, by a usually taller stem, and by the shape of the petals. In *S. wardii* the petals are abruptly unguiculate, the limb nearly orbicular with the margin adorned all round with crimson glands (black when dry). In var. *gouldii*, which is recorded from further west in Bhutan and Tibet, the glands are restricted to the upper part of the petal and the limb is cuneately narrowed into the claw. The new variety agrees perfectly with the typical one except that the upper part of the petal is finely laciniate instead of bearing marginal glands. It is noteworthy that only this variety was collected. It is hardly to be supposed that the typical plant was overlooked. Var. *eglandulosa* may thus be geographically distinct ; or it may represent the normal condition of the species, and var. *gouldii* a rare modification.

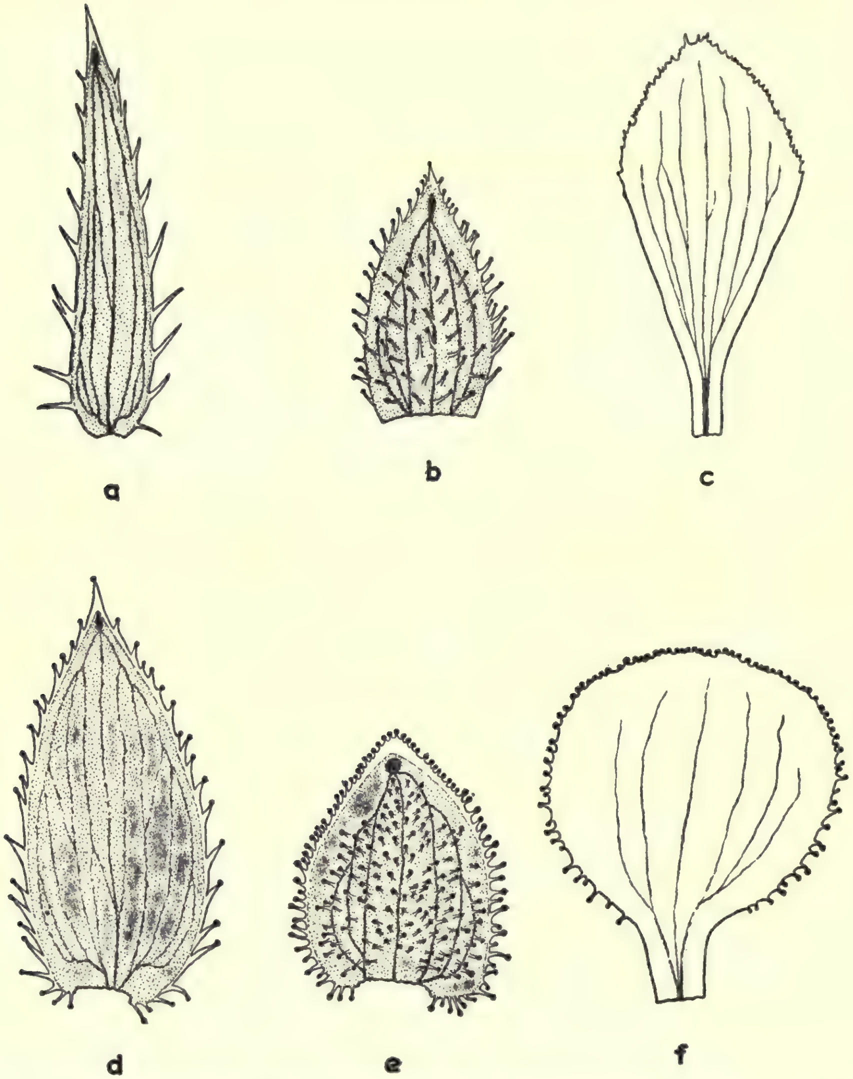


FIG. 12. *Saxifraga gouldii* var. *eglandulosa* H. Sm. (holotype) : *a*, cauline leaf ; *b*, sepal ; *c*, petal. *S. wardii* W. W. Sm. (*Ludlow, Sherriff & Hicks 16915*) : *d*, cauline leaf ; *e*, sepal ; *f*, petal. (All × 5.)

Saxifraga erinacea H. Sm., sp. nov. (Fig. 13 *a–e* ; Plate 20 B.)

Species ex affinitate *S. brachypodae* D. Don. Planta subdioica, glabra, caulibus sterilibus et fertilibus aggregatis erectis c. 1 (–2) cm. altis densissime foliatis.

Caules glabri, internodiis brevissimis. *Folia* aequimagna, nitentia, lanceolata, 6–7 mm. longa, 1·5–2 mm. lata, margine hyalino-cartilaginea et cartilagineo-spinulosa, spina apicali maxima ad 1·5 mm. longa, lateralibus paullo minoribus pro latere

6–8 omnibus eglandulosis, nervis 3 sub apice confluentibus lateralibus (in sicco) conspicuis. *Flores* solitarii, apicales, subsessiles, c. 9 mm. longi. *Sepala* ovata, 5–5·5 mm. longa, 2·5–3 mm. lata, margine cartilagineo-spinulosa, spinis (basalibus exceptis) glanduliferis, apicalibus praesertim erecto-directis, nervis 3 basali parte ramosis sub apice confluentibus. *Petala* lutea, lanceolato-linearia, supra unguem 2·5 mm. longum auriculata, acuta, c. 8 mm. longa et 2 mm. lata, nervis 3–5. *Stamina* in planta submascula 5 mm. longa, antherae thecis subglobosis vix 0·6 mm. longis ;

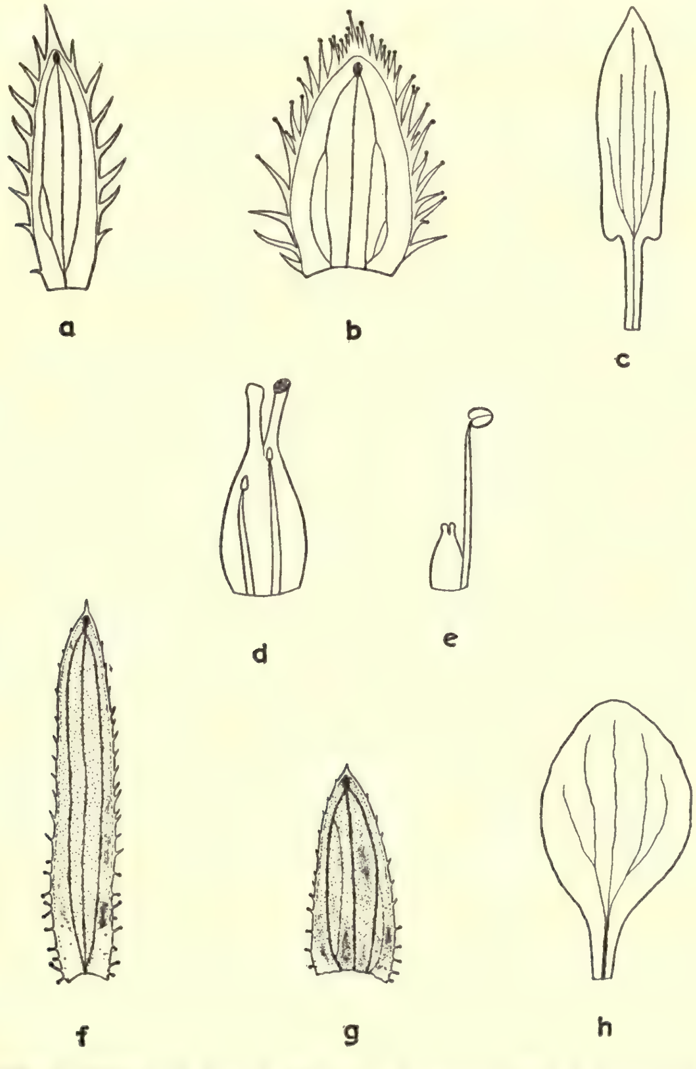


FIG. 13. *Saxifraga erinacea* H. Sm. (holotype) : *a*, cauline leaf ; *b*, sepal ; *c*, petal ; *d*, ovary and stamens from subfemale flower ; *e*, ovary and stamen from submale flower. *S. serrula* H. Sm. (holotype) : *f*, cauline leaf ; *g*, sepal ; *h*, petal. (All × 5.)

in planta subfeminea 3–4 mm. longa, thecis minutis polline carentibus. *Ovarium* in planta submascula reductum, aetate non increscens; in planta subfeminea ovoideum, c. 5 mm. longum, stylis erectis subclaviformibus 1·5 mm. longis. *Capsula* matura adhuc non visa.

BHUTAN: Me La, 4,200 m., 4 Aug. 1933, *Ludlow & Sherriff 376* (stem up to 2 cm. in length). Me La-Cho La valley, 4,200 m., 2 July 1949, *Ludlow, Sherriff & Hicks 20912*.

S.E. TIBET: Between Me La and Cho La, 4,050 m.; on open hillside; corolla bright yellow; 21 Aug. 1949, *Ludlow, Sherriff & Hicks 21409* (holotype in Herb. Brit. Mus.).

Saxifraga serrula H. Sm., sp. nov. (Fig. 13 *f–h*; Plate 21 A.)

Planta ex affinitate *S. brachypodae* D. Don, habitu, quamquam robustior et parce ramosa, *S. filicaulem* Wall. ex Ser. aemulans.

Caulis uniflorus, 4–16 cm. longus, c. 0·6 mm. diam.; pars infima, annotina vel vetustior, decumbens, 1–8 cm. longa, foliis evanidis vel emarcidis; pars superior ascendenter erecta, unilateraliter pauciramosa, ramis 2–4 cm. longis sterilibus densifoliatis. *Folia* caulina linearia, patentia, saepe arcuato-recurvantia, caulem subamplectentia, c. 10 mm. longa et 1·5 mm. lata, nitentia, apice mucronata, infima minore parte marginis glanduloso-pilosa, superiore majore parte minute et acutissime cartilagineo-ciliata, nervis 3 sub apice confluentibus, lateralibus conspicue impressis. *Flores* apicales, 1–1·5 cm. longe pedicellati, pedicello pilis strictis glanduliferis ecoloratis subdense obsito. *Sepala* anguste ovata, 5·5 mm. longa, 2.2 mm. lata, ceterum foliis conformia. *Petala* lutea, elliptica, in unguem 1·5 mm. longum contracta, c. 7·5 mm. longa et 4 mm. lata, ecallosa. *Stamina* petalis paullo breviora, antherae thecis subglobosis 0·5 mm. longis. *Ovarium* superum, ovoideum, 3·4 mm. altum, stylis divaricantibus fere 2 mm. longis.

BHUTAN: Chendebi, 3,000 m.; midst grass on dry soil; calyx green; corolla yellow; 7 Aug. 1949, *Ludlow, Sherriff & Hicks 17073* (holotype in Herb. Brit. Mus.).

This is an interesting plant, which unquestionably links the rather isolated *S. filicaulis* Wall. ex Ser. with the *S. brachypoda* group.

Grex SEDIFORMES Engler & Irmscher

Saxifraga contraria H. Sm., sp. nov. (Fig. 14 *a–d*.)

Planta foliis oppositis singularis, *S. engleranae* H. Sm. remote affinis. Caespites laxos humiles formans, caulibus numerosis 1·2–3·3 cm. altis unifloris.

Caudiculi glabri, primum hypogaei, repentes, tenuissimi, sparse et minutissime foliati, ramificantes demum assurgentes accrescentes densius et robustius foliati apice caulem floriferum producentes; caulis florifer pilis brevibus crispulis albescentibus rufescentibusve eglandulosis instructus. *Folia* caudiculorum semper opposita, basi non connata, carnosa, elliptico-obovata, ad 2·5 mm. longa et c. 2 mm. lata, glabra; folia caulina in paribus 1–2 opposita vel interdum alternantia, 3–4 mm. longa, c. 2 mm. lata, glabra. *Sepala* glabra, late ovato-elliptica, ad 2·5 mm. longa et 2 mm. lata, nervis 3 sub apice confluentibus. *Petala* lutea vel aurantiaca, elliptica, breviter unguiculata, 3·5–4 mm. longa, 1·8 mm. lata, subelevate 2-callosa, 3-nervia. *Stamina* petalis ⅓ breviora, antherae thecis crassis 0·8 mm. longis. *Ovarium* superum, basi annulatum, globoso-conicum, stylis 0·5 mm. longis.

NEPAL: Arun-Tamur watershed, Thagla Bhanjyang, north of Topke Gola, 4,500 m., 14 July 1956, *Stainton 995*.

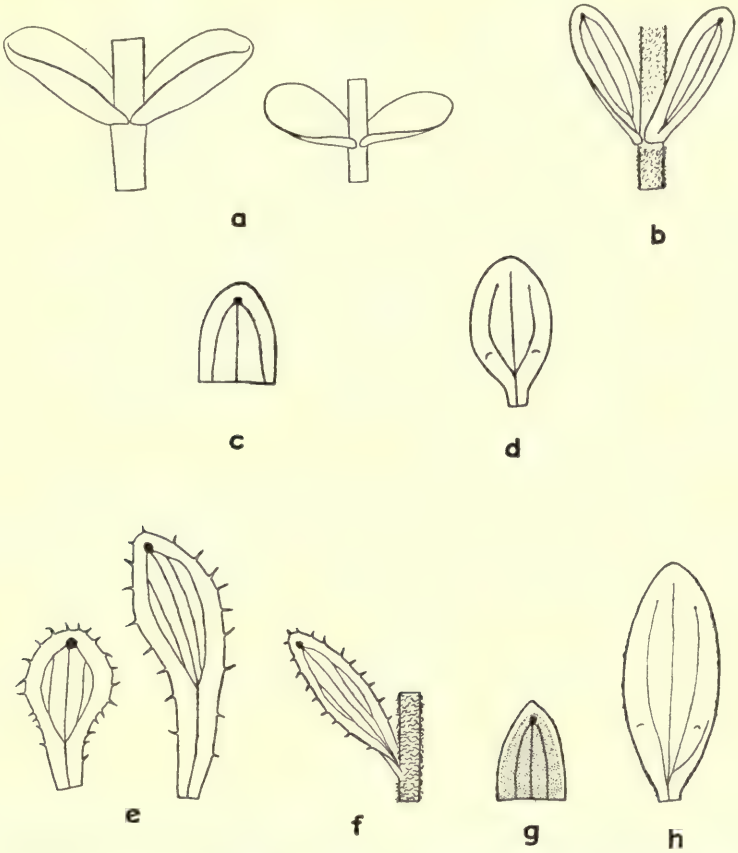


FIG. 14. *Saxifraga contraria* H. Sm. (holotype): *a*, caudicles with leaves; *b*, stem with cauline leaves; *c*, sepal; *d*, petal. *S. miralana* H. Sm. (holotype): *e*, rosular leaves; *f*, stem with cauline leaf; *g*, sepal; *h*, petal. (All × 5.)

BHUTAN: Gafoola, upper Pho Chu, 4,200 m., 5 July 1949, *Ludlow, Sherriff & Hicks 16736*. Waitang, Tsampa, 4,200 m.; in little clumps among stones beside streams; corolla yellow; 17 June 1949, *Ludlow, Sherriff & Hicks 19178* (holotype in Herb. Brit. Mus.). Marlung, Tsampa, 4,350 m., 9 July 1949, *Ludlow, Sherriff & Hicks 19390*.

S.E. TIBET: Reting, 60 miles north of Lhasa, 4,350 m., 18 July 1944, *Ludlow & Sherriff 11017*.

Forma **rubella** H. Sm., forma nov.

A typo distat petalis aurantiaco-rubris paullo latioribus, stylis fere 1 mm. longis.

BHUTAN : Woji, upper Pho Chu, 3,900 m. ; on rocks in stony river bed ; calyx green ; corolla orange-red ; filaments red, anthers yellow ; ovary red-green ; 21 June 1949, *Ludlow, Sherriff & Hicks 16605* (holotype in Herb. Brit. Mus.).

Saxifraga miralana H. Sm., sp. nov. (Fig. 14 *e–h*.)

Species affinis *S. engleranae* H. Sm., a qua distat statura robustiore, foliis omnibus margine aculeolato-ciliatis (nec glabris), floribus majoribus, petalis angustioribus. Dense caespitosa, caulibus numerosis 1–2·5 cm. altis unifloris.

Caulis florifer pilis brevibus crispulis albescentibus eglandulosis laxe vestitus, inferiore tertia parte 1–3-foliatus, foliis supremis interdum oppositis. *Folia* rosularia crassiuscula, rigida, obovato-spathulata, ad 9 mm. longa et c. 2 mm. lata, margine argute aculeolato-ciliata, nervis ramosis in verruculam confluentibus ; folia caulina 3–5 mm. longa, 1·3 mm. lata, margine ciliata. *Hypanthium* glabrum. *Sepala* ovato-triangularia, patentia sed non reflexa, 1·6–2 mm. longa, 1·5 mm. lata, glabra, nervis 3 sub apice confluentibus. *Petala* lutea, medio aurantiaco-maculata, elliptica, vix unguiculata, subacuta, 6–7 mm. longa, 2·5 mm. lata, ecallosa vel obsolete 2-callosa, 3-nervia. *Stamina* petalis ⅓ breviora. *Ovarium* superum, parum fissum, globoso-conicum, stylis 0·5 mm. longis.

S.E. TIBET : Kongbo, Puchu, Nyang Chu, Mira La, 29° 30′ N., 94° 15′ E., 4,800 m. ; on loose granitic scree ; sepals green, mottled reddish-purple, spreading ; petals lemon-yellow, spotted orange-yellow in the middle ; filaments greenish-yellow ; anthers greenish-yellow ; capsule green ; 16 Aug. 1938, *Ludlow, Sherriff & Taylor 6078* (holotype in Herb. Brit. Mus.).

SAXIFRAGA STELLA-AUREA Hook. & Thoms. in Journ. Proc. Linn. Soc. Lond., Bot. ii : 72 (1857).

Var. **polyadena** H. Sm., var. nov. (Fig. 15 *a–c*.)

A typo (var. *stella-aurea*) distat planta majore et robustiore ; rosulae foliis ad 4·5 mm. longis et 1·6 mm. latis, margine et dorsi apicali dimidia parte glanduloso-pilosis (nec margine solum sparsim glandulosis) ; sepalis ad 2·2 mm. longis et 1·6 mm. latis, dorso margineque glanduloso-pilosis (nec ad 1·9 mm. longis et 1·3 mm. latis, glabris vel rarissime glandulis perpaucis instructis).

NEPAL : Khola Kharka, 4,050 m., 17 July 1949, *Polunin 1090*. Langtang valley, 4,500 m., June 1949, *Polunin 665*. Chilime Kharka, 4,500 m., July 1949, *Polunin 1152*. Same locality, 1949, *Polunin 1484*. Chilime Kharka–Chilimagaon, 4,500 m., 26–28 July 1949, *Polunin 1470*.

S.E. TIBET : Kongbo, Budi Tsepo La, 3,900 m. ; in mats on rock ; corolla yellow or orange-yellow or orange-red ; 21 Aug. 1947, *Ludlow, Sherriff & Elliot 14425* (holotype in Herb. Brit. Mus.). Same locality, 3,900 m., 21 Aug. 1947, *Ludlow, Sherriff & Elliot 14423*. Same locality, 4,050 m., 18 June 1947, *Ludlow, Sherriff & Elliot 15270*. Kongbo, Mira La, Nyang Chu, Puchu, 4,650 m., 15 Aug. 1938, *Ludlow,*

Sherriff & Taylor 6074 (together with *S. jacquemontiana*). Kongbo, Pero La, Tsangpo valley, 29° 30′ N., 95° E., 4,050 m., 9 July 1938, *Ludlow, Sherriff & Taylor 5194* (together with var. *stella-aurea*). Salween-Tsangpo divide, N.E. of Shugden Gompa, 4,800 m., 11 Aug. 1933, *Kingdon-Ward 10750a.*

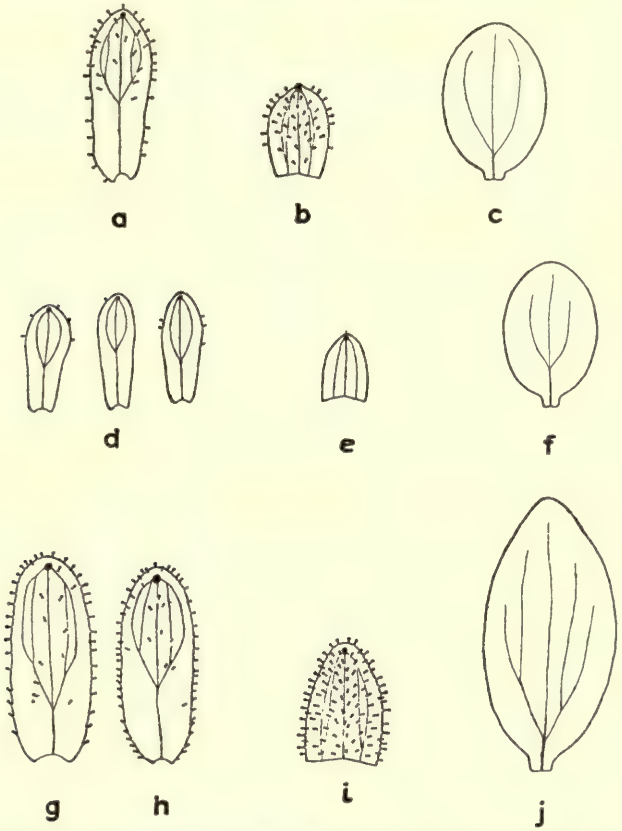


FIG. 15. *Saxifraga stella-aurea* var. *polyadena* H. Sm. (holotype) : *a*, rosular leaf ; *b*, sepal ; *c*, petal. *S. stella-aurea* Hook. & Thoms. var. *stella-aurea* (*Ludlow, Sherriff & Elliot 14424*) : *d*, rosular leaves ; *e*, sepal ; *f*, petal. *S. finitima* W. W. Sm. (*Kingdon-Ward 4096*, except *h*) : *g*, rosular leaf ; *h*, rosular leaf (type coll.) ; *i*, sepal ; *j*, petal. (All × 5.)

The var. *polyadena* is not uniform, and is probably the result of hybridization between *S. stella-aurea* var. *stella-aurea* (Fig. 15 *d–f*) and *S. finitima* W. W. Sm. (Fig. 15 *g–j*) or *S. jacquemontiana* Decne., being sometimes reminiscent of the one (*L., S. & E. 14423*), sometimes of the other (*L., S. & T. 5194*).

Saxifraga lhasana H. Sm., sp. nov.

Species ex affinitate *S. umbellulatae* Hook. & Thoms., a qua inter alia distat rosulae foliorum lamina crebre aculeolato-ciliata (nec glabra vel in statu juvenili

sparsissime ciliata), petalis albis (nec luteis), staminum filamentis vix 3 mm. longis (nec 4 mm.). Rosulae solitariae vel paucae arcte confertae, densissime foliatae, 1·5–2·4 mm. diam.; caulis florifer 4–6 cm. altus; flores 5–11 in ramis 3–4 subumbellatim dispositis.

Var. **lhasana.** (Fig. 16 *a–f*.)

Caulis florifer tota longitudine glanduloso-pilosus. *Folia* rosularia 5–10 mm. longa, 1·5–1·8 mm. lata, lamina rotundato-elliptica apice incrassata et modice recurvanti, basi in petiolum fere aequilatum parum attenuata margine aculeolato-ciliata; folia caulina sparsa, sub umbellam 3–5 conferta, lanceolata, ad 5 mm. longa et 1·5 mm. lata, apice obtusa, dorso margineque glanduloso-pilosa, glandulis apicalibus majoribus subsessilibus. *Hypanthium* glanduloso-pilosum. *Sepala* ovato-

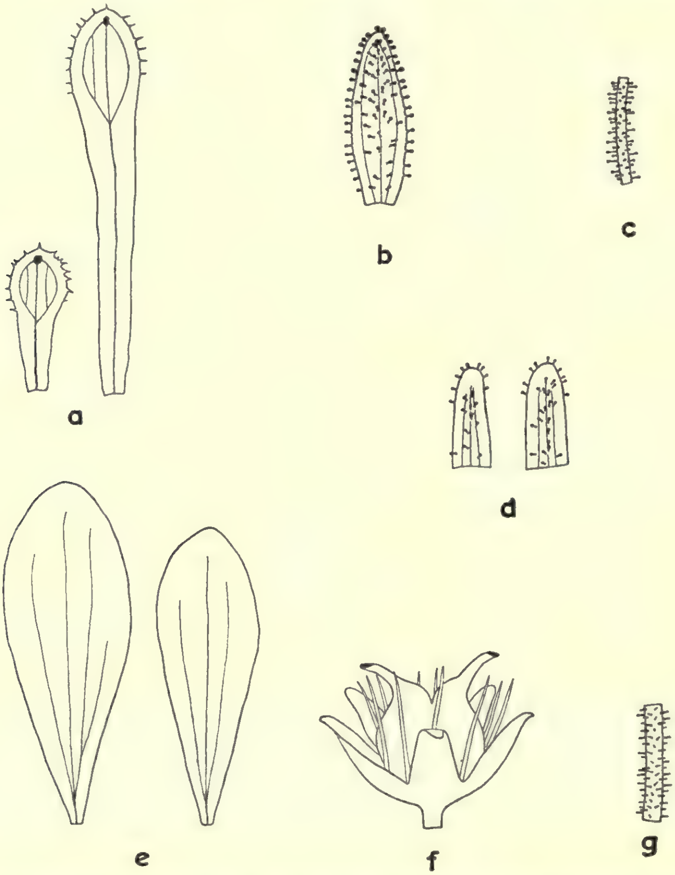


FIG. 16. *Saxifraga lhasana* H. Sm. var. *lhasana* (holotype) : *a*, rosular leaves ; *b*, cauline leaf ; *c*, pedicel ; *d*, sepals ; *e*, petals ; *f*, capsule (hairiness not depicted). *S. lhasana* var. *decapitulata* H. Sm. (holotype) : *g*, pedicel. (All × 5.)

linearia, obtusa, ad 2·6 mm. longa et c. 1 mm. lata, dorso etiam marginis hyalino-membranacei apicali dimidia parte sparse et tenuiter glanduloso-pilosa, nervis 3 liberis. *Petala* alba, anguste obovata, ad basin sensim angustata 8–9 mm. longa, 2·6–3·2 mm. lata. *Stamina* petalis fere triplo breviora. *Ovarium* superum, in maturitate subglobosum 2·8 mm. longum et crassum, stylis divaricantibus 1 mm. longis.

S.E. TIBET : Reting, 60 miles north of Lhasa, 4,650 m. ; on large boulders ; flowers white ; 31 July 1942, *Ludlow & Sherriff 8997* (holotype in Herb. Brit. Mus.). Same locality, 4,200 m., 20 July 1944, *Ludlow & Sherriff 11039*. Lhasa, 3,600 m., 1 July 1943, *Ludlow & Sherriff 9734*. Vicinity of Lhasa, July 1939, *Richardson 237*.

Var. **decapitulata** H. Sm., var. nov. (Fig. 16 *g*.)

A var. *lhasana* distat pilis totae plantae nigris glandula normaliter destitutis, apice obsolete incrassatis ; planta robustiore, inflorescentia magis divaricato-ramosa ; sepalis lineari-triangularibus, minus hyalino-marginatis ; petalis ad 3 mm. latis, magis patentibus ; capsula majore ad 3·8 mm. longa et crassa.

S.E. TIBET : Gyamda valley, above Gyamda, 3,300–3,600 m. ; on sunny cliffs ; flowers white ; 23 Aug. 1935, *Kingdon-Ward 12254* (holotype in Herb. Brit. Mus.).

Saxifraga brunneopunctata H. Sm., sp. nov. (Fig. 17 *a–d*.)

Species affinis *S. umbellulatae* Hook. & Thoms., a qua distat statura minore, rosulae foliorum lamina margine breviter aculeolato-ciliata (nec glabra vel in statu juvenili sparsissime ciliata), floribus minoribus, petalis brunneo-punctatis, stylis brevissimis in capsula matura stricte patentibus (nec 1 mm. longis, suberectis).

Rosulae solitariae vel paucae arcte confertae, densissime foliatae, 1–1·8 cm. diam., caulem floriferum 2–4 cm. altum dense glanduloso-pilosum c. 12-foliatum edentes, floribus 1–11 in ramis 1–4 subumbellatim dispositis. *Folia* rosularia spathulata, 5–7 mm. longa, lamina elliptica 2–2·5 mm. lata in petiolum latum modice angustata margine breviter aculeolato-ciliata, nervis c. 5 in verruculam confluentibus ; folia caulina ovato-lanceolata, ad 4·5 mm. longa, dorso margineque subdense glanduloso-pilosa, glandulis apicalibus magnis fere sessilibus. *Hypanthium* glanduloso-pilosum. *Sepala* ovata, subobtusa, vix 2 mm. longa et 1·3 mm. lata, dorso modice, etiam margine membranaceo sparsissime, minute glanduloso-pilosa, nervis 3–5 sub apice in verruculam confluentibus. *Petala* lutea, inferiore dimidia parte minute brunneo-punctata, lanceolata, exunguiculata, subobtusa, ad 5 mm. longa et 1·6 mm. lata, obsolete 2-callosa, 3-nervia. *Stamina* petalis paullo breviora. *Ovarium* superum, subglobosum, stylis brevissimis demum valde divaricatis.

S.E. TIBET : Chu Nullah, Gyantse, 30 Aug. 1925, *Ludlow 169*. Reting, 60 miles north of Lhasa, 4,800 m. ; in open moorland on top of pass ; flowers yellow with orange anthers; 21 July 1942, *Ludlow & Sherriff 8848* (holotype in Herb. Brit. Mus.). Same locality, 4,200 m., 29 July 1944, *Ludlow & Sherriff 11079*. Vicinity of Lhasa, 3,900 m., Sept. 1939, *Richardson 260*. Hills south of Lhasa, Sha La, 4,200 m., 11 July 1943, *Ludlow & Sherriff 9750*.

Saxifraga anadena H. Sm., sp. nov. (Fig. 17 *e–h*.)

Planta habitu *S. heterotrichae* Marquand & Airy Shaw subsimilis, sed caule et foliorum caulinorum margine pilis eglandulosis subrobustis erectis nigro-rubescentibus brevissimis (0·2 mm. vel minus longis) sublaxe instructis, valde distincta.

Rosulae solitariae vel paucae confertae, densissime foliatae, c. 1 cm. diam.; caulis florifer tenuis, 4–5 cm. altus, laxe 8–13-foliatus, flores 1–2 longe pedicellatos

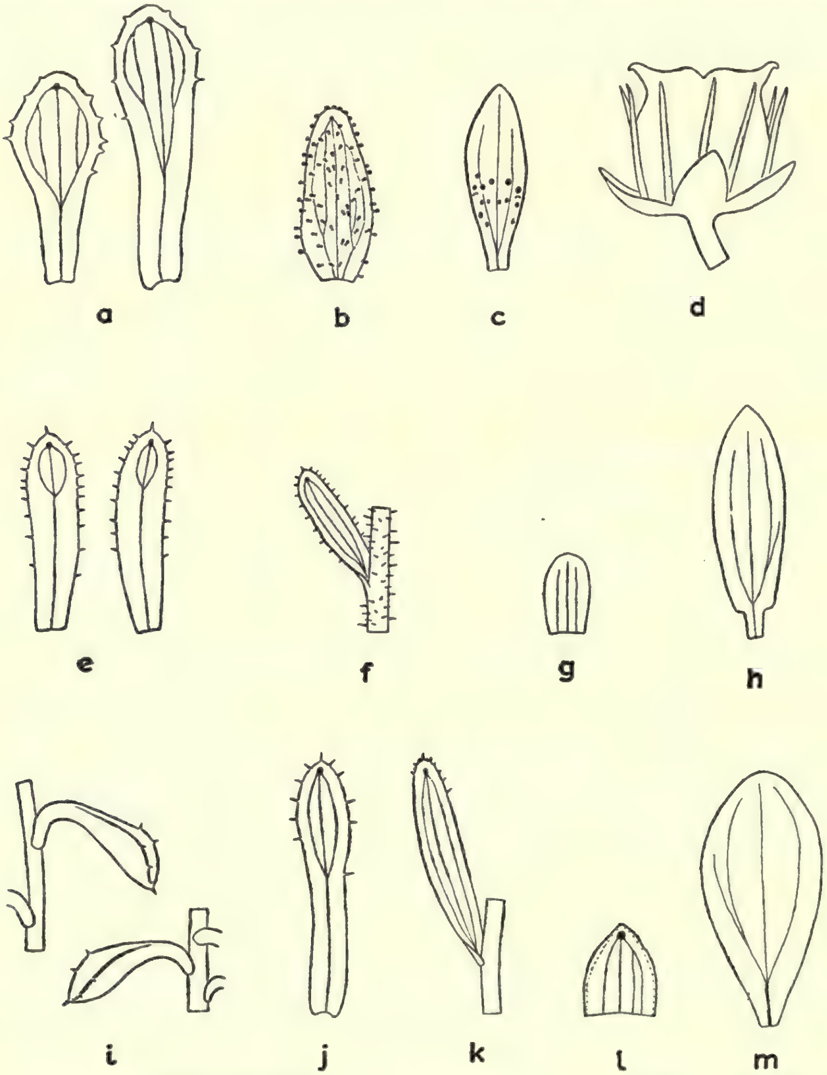


Fig. 17. *Saxifraga brunneopunctata* H. Sm. (holotype): *a*, rosular leaves; *b*, cauline leaf; *c*, petal; *d*, capsule (hairiness not depicted). *S. anadena* H. Sm. (holotype): *e*, rosular leaves; *f*, stem with cauline leaf; *g*, sepal; *h*, petal. *S. anisophylla* H. Sm. (holotype): *i*, caudicles with leaves; *j*, rosular leaf; *k*, stem with cauline leaf; *l*, sepal; *m*, petal. (All × 5.)

gerens. *Folia* rosularia sublinearia, 3–5·5 mm. longa, ad 1·2 mm. lata, apice acuta, margine superiore dimidia parte, vel ultra, breviter aculeolato-ciliata, ciliis inferioribus tenuioribus ; folia caulina linearia, apice obtusa, nervis 3 sub apice confluentibus. *Hypanthium* glabrum. *Sepala* late linearia, rotundato-obtusa, in anthesi reflexa, 2 mm. longa, 1·2 mm. lata, glabra, nervis 3 liberis. *Petala* lutea, lanceolata, breviter sed distincte unguiculata, subobtusa, 6 mm. longa, 1·9 mm. lata, 3-nervia. *Stamina* petalis vix ⅓ breviora. *Ovarium* superum, parum fissum, globoso-cylindricum, stylis 0·7 mm. longis aetate divaricantibus.

S.E. TIBET : Kongbo, Penam Chu, near Je, Pasum Tso, 3,900 m., 8 July 1947, *Ludlow, Sherriff & Elliot 14092*. Kongbo, Ba La, Pasum Chu, 4,350 m.; calyx reddish-green ; corolla yellow ; 29 June 1947, *Ludlow, Sherriff & Elliot 14033a* (holotype in Herb. Brit. Mus.).

Saxifraga anisophylla H. Sm., sp. nov. (Fig. 17 *i–m*.)

Species fortasse *S. filifoliae* Anthony affinis, sed multo major. Planta caespites magnos laxos formans, pilis glandulisque omnino destituta etiamsi foliis margine modice aculeolato-ciliatis ; caules numerosi, nitenter glabri, 6–16 cm. alti, uniflori vel ramos 1–3 distantes unifloros gerentes.

Caudiculi trimorphi : hypogaei tenuissimi, longe repentes, sparse et minutissime foliati ; epigaei laxe caespitosi, repentes, ad 12 cm. longi, laxe foliati, foliis recurvato-patentibus breviter petiolatis, lamina valde incrassata obovata ad 3 mm. longa et 2 mm. lata, apice margineque parce et breviter aculeolato-ciliata ; caudiculi demum rosulam dense foliatam ad 1·3 cm. diam. formantes, foliis lineari-spathulatis ad 7 mm. longis, lamina incrassata elliptica fere 3 mm. longa et 1·4 mm. lata, basi in petiolum latum modice angustata, margine remote aculeolato-ciliata ; folia caulina 6–10, remota, lanceolato-linearia, ad 6 mm. longa et 1·2 mm. lata, suprema integra, media et inferiora apicaliter modice aculeato-ciliata. *Hypanthium* glabrum. *Sepala* acute ovata, patentia, ad 2·5 mm. longa et 1·9 mm. lata, glabra, anguste hyalino-marginata, nervis 3–5 sub apice confluentibus. *Petala* lutea, inferne aurantiaco-maculata, obovata, exunguiculata, ad 6·5 mm. longa et 3·2 mm. lata, obsolete 2-callosa, nervis 3–5. *Stamina* petalis subduplo breviora. *Ovarium* superum, globoso-conicum, stylis brevissimis (an planta submascula solum collecta?).

BURMA : Sources of the Irrawaddy, Adung valley, 28° 20′ N., 97° 40′ E., 3,900 m. ; in clumps amongst coarse boulders ; calyx, stems and fleshy stem leaves glabrous ; basal rosette leaves also fleshy with bristly margins, the bristles colourless and wide apart ; flowers bright yellow, only the lower half of the petals spotted with orange ; 5 Aug. 1931, *Kingdon-Ward 9904* (holotype in Herb. Brit. Mus.).

Sect. SAXIFRAGA (Sect. *Nephrophyllum* Gaudin)

Grex SIBIRICAE Engler & Irmscher

Saxifraga granulifera H. Sm., sp. nov. (Plate 21 B.)

Planta ex affinitate *S. cernuae* L. sed distat caule gracili, foliis caulinis subaequimagnis, bracteis foliaceis lobatis, bulbillis minutissimis in axillis foliorum solum productis (nec etiam ad basin caulis et ad bracteas lineares numerosas).

Caulis 10–25 cm. altus, 0·4–1·2 mm. diam., simplex vel superne pauciramosus, 6–8-foliatus, deorsum albo-pilosus, sursum glanduloso-pilosus. *Folia* omnia tenera vix crassiuscula; basalia longe petiolata, lamina ambitu subrotundata ad 1 cm. longa et 1·3 cm. lata palmatim c. 6-loba, lobis late ovatis ad triangulari-ovatis; folia caulina sursum modice decrescentia, brevius petiolata, lamina ambitu subrotundata palmato-lobata, lobis triangularibus, in bracteis perpaucis lobatis sensim deminuta. *Bulbilli* 1–plures, ovoidei, c. 0·5 × 0·7 mm. magni, glabri, in axillis foliorum caulis producti. *Flores* 1–2 cm. longe pedicellati, 1–5 (–9) in apicibus ramorum solitarii. *Calycis* tubus 1 mm. longus vel brevior; sepala ovato-lanceolata, 2 mm. longa et 1 mm. lata. *Petala* alba vel sulphurea, oblongo-linearia, ad 7 mm. longa et 2·5 mm. lata. *Stamina* 2·5–3 mm. longa, antherae thecis subrotundatis c. 0·3 mm. diam. *Ovarium* ovoideum, stylis erectis 1·3 mm. longis.

NEPAL: Bhurchula Lekh, near Jumla, 3,750 m., 10 July 1952, *Polunin, Sykes & Williams 4504*. Maharigaon, 3,900 m., 21 July 1952, *Polunin, Sykes & Williams 234*. Near Tarakot, Bheri River, c. 3,450 m., 14 July 1952, *Polunin, Sykes & Williams 2459*. Near Phagune Dhuri, 3,600 m., 7 July 1954, *Stainton, Sykes & Williams 3413*. Rambrong, Lamjung Himal, 4,350 m., 7 July 1954, *Stainton, Sykes & Williams 6220*. Bimtakothi, 3,750 m., 27 Aug. 1950, *Lowndes 1468*. Ganesh Himal, Shiar Khola, 3,150 m., 18 July 1953, *Gardner 1409*. Langtang, lateral valley, 3,600–3,750 m., 1 Aug. 1949, *Polunin 1507*. Changbu Khola, 4,350 m., 15 June 1949, *Polunin 316*. Bozal, 2,700 m., 30 Aug. 1931, *Sharma* E*113*. Bheding, 3,600–3,900 m., 1930, *Lall Dhwoj 0330*.

BHUTAN: Leji, upper Pho Chu, 3,600 m., 28 June 1949, *Ludlow, Sherriff & Hicks 16666*. Me La-Cho La valley, 3,750 m.; on ledges of cliff; flowers white; 1 July 1949, *Ludlow, Sherriff & Hicks 20440* (holotype in Herb. Brit. Mus.).

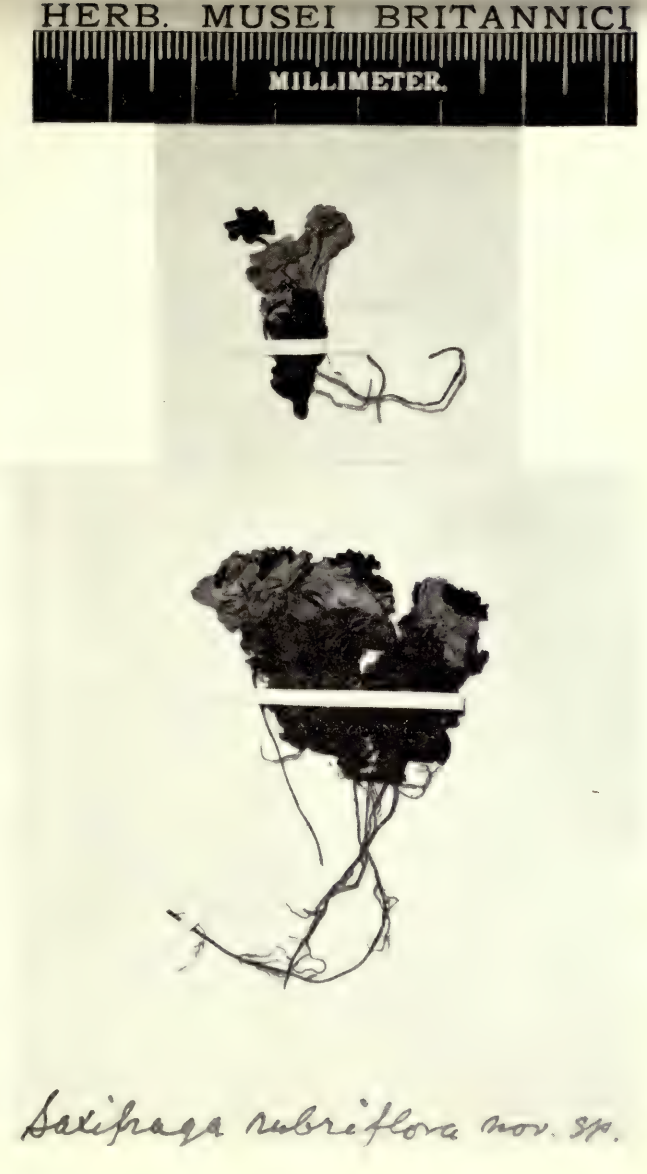
S.E. TIBET: Phari, Tang La, Aug. 1879, *Dungboo*. Hills west of Lhasa, beyond Trisum, 4,200 m., 1 Sept. 1942, *Ludlow & Sherriff 9046*. Kongbo, Penam Chu, near Je (Pasum Lake), 4,350 m., 10 July 1947, *Ludlow, Sherriff & Elliot 14109*. Kongbo, valley above Sang, 29° 29′ N., 94° 41′ E., 3,150 m., 26 June 1938, *Ludlow, Sherriff & Taylor 5001*. Kongbo, valley above Tripe, west of Namcha Barwa, 29° 39′ N., 94° 41′ E., 3,600 m., 25 July 1938, *Ludlow, Sherriff & Taylor 5393*.

PLATE 13

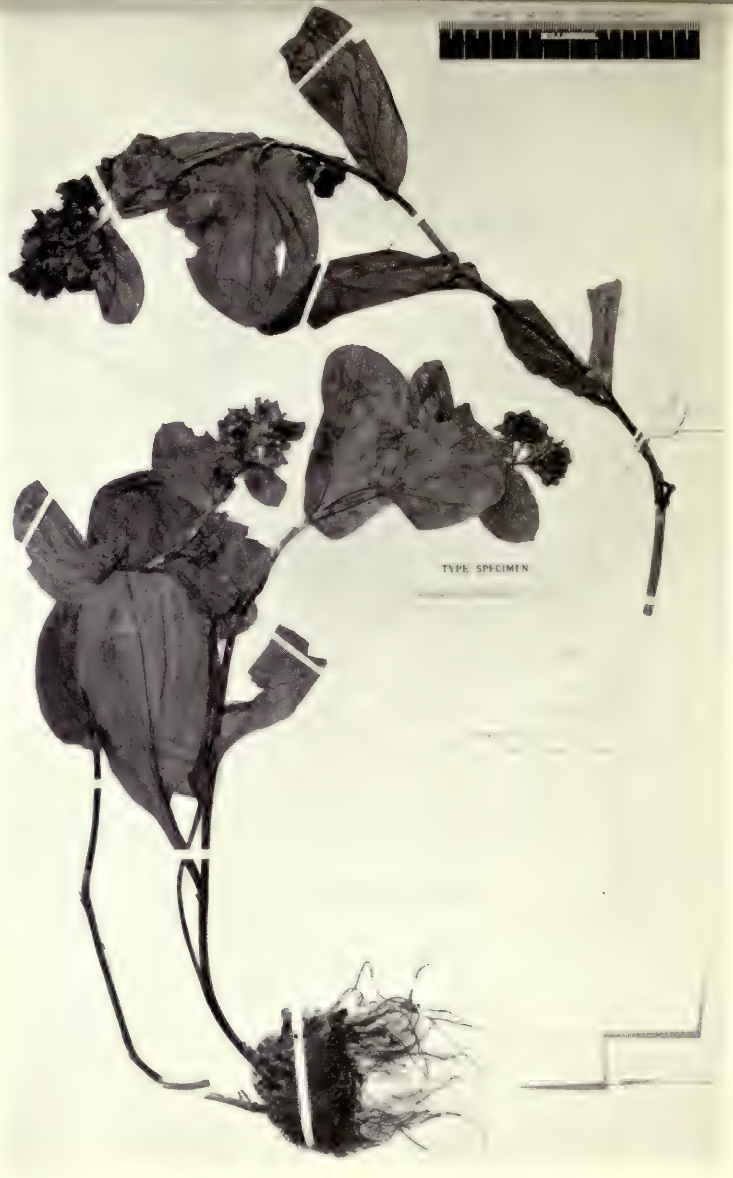
A. *Saxifraga rubriflora* H. Sm.

B. *Saxifraga excellens* H. Sm.

BRITISH MUSEUM 1960 NATURAL HISTORY


HERB. MUSEI BRITANNICI
MILLIMETER.
Saxifraga rubriflora nov. sp.

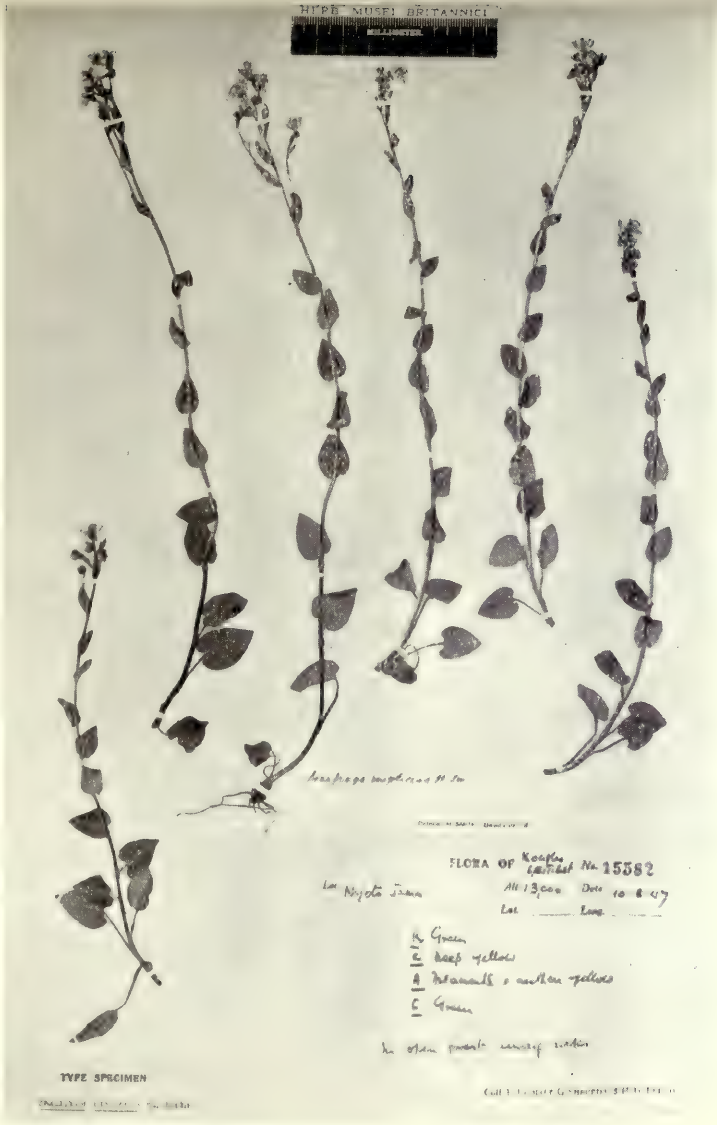
A. Holotype of *Saxifraga rubriflora* H. Sm.


TYPE SPECIMEN

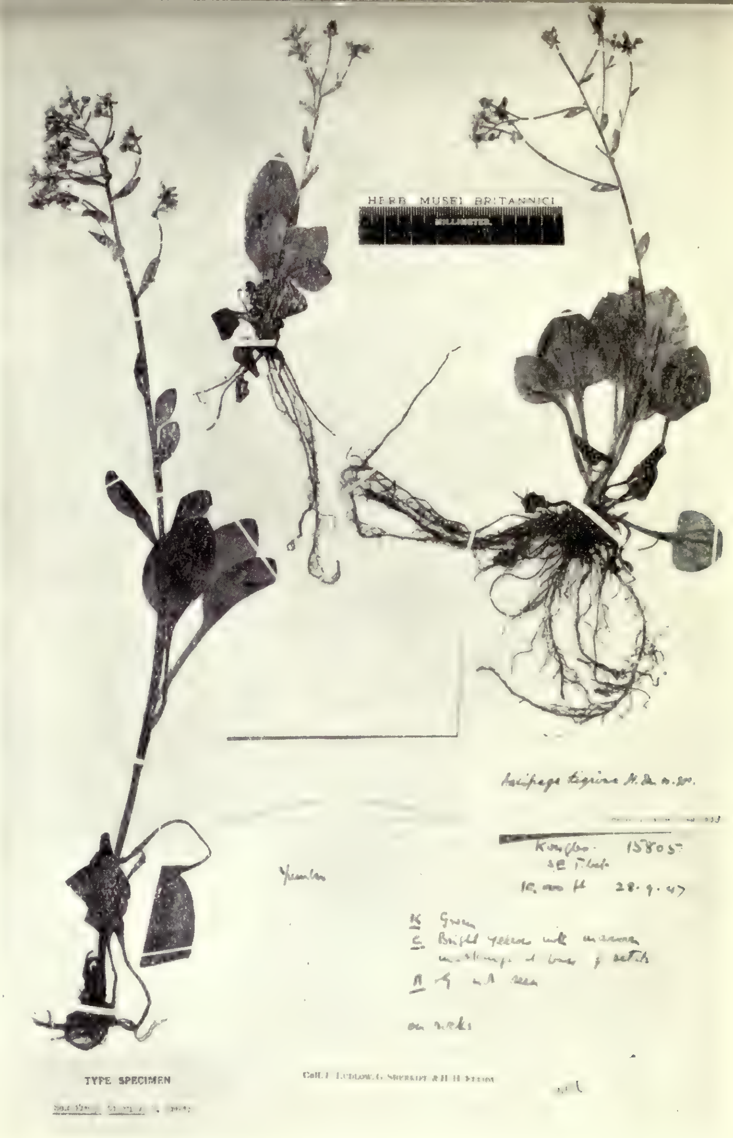
B. Holotype of *Saxifraga excellens* H. Sm.

PLATE 14

A. *Saxifraga implicans* H. Sm.
B. *Saxifraga tigrina* H. Sm.


HERB. MUSEI BRITANNICI
MILLIMETER
FLORA OF No. 15582
Alt 13,000 Date 10 8 47
Lat. Long.
TYPE SPECIMEN

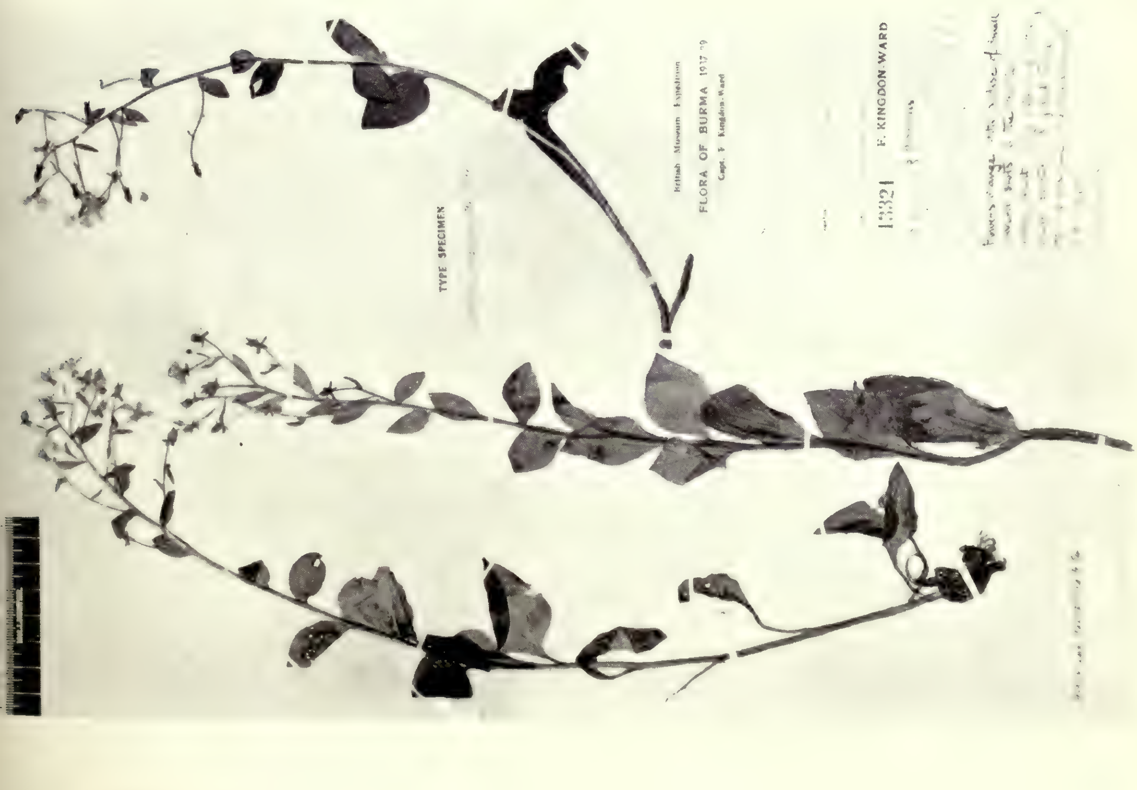
A. Holotype of *Saxifraga implicans* H. Sm.


HERB. MUSEI BRITANNICI
MILLIMETER
15805
28. 9. 47
TYPE SPECIMEN

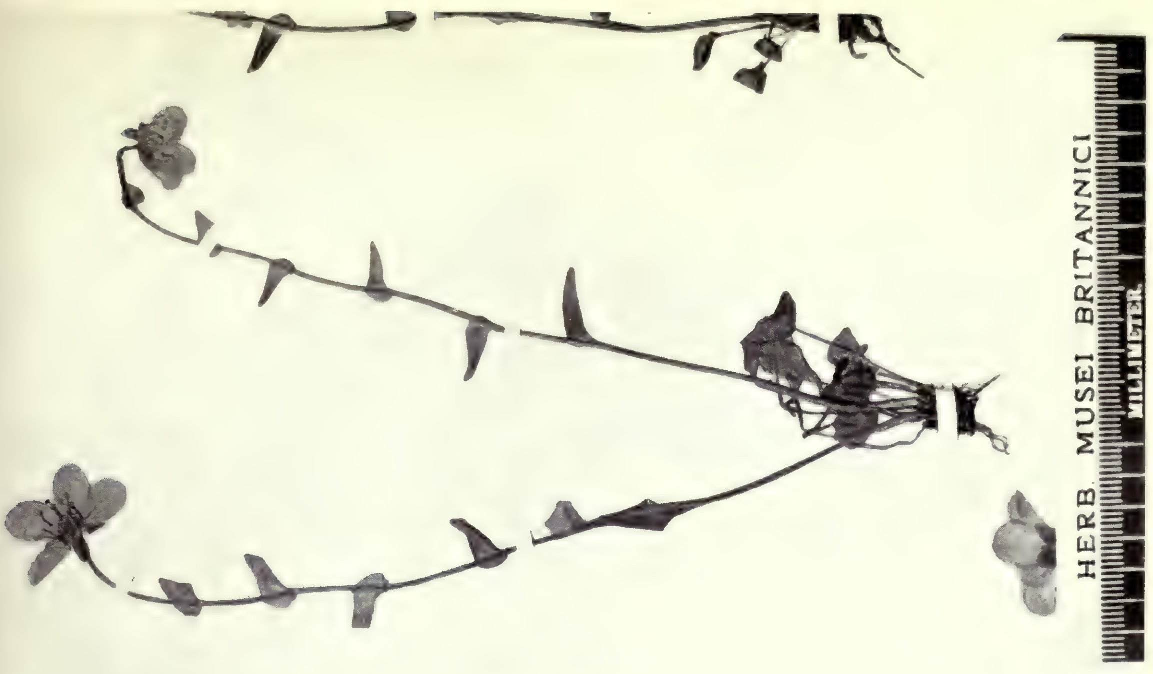
B. Holotype of *Saxifraga tigrina* H. Sm.

PLATE 15

A. *Saxifraga calopetala* H. Sm.
B. *Saxifraga sphaeradena* H. Sm. subsp. *sphaeradena*


TYPE SPECIMEN
British Museum Expedition
FLORA OF BURMA 1937-39
Capt. F. Kingdon-Ward
13321
F. KINGDON-WARD

A. Holotype of *Saxifraga calopetala* H. Sm.

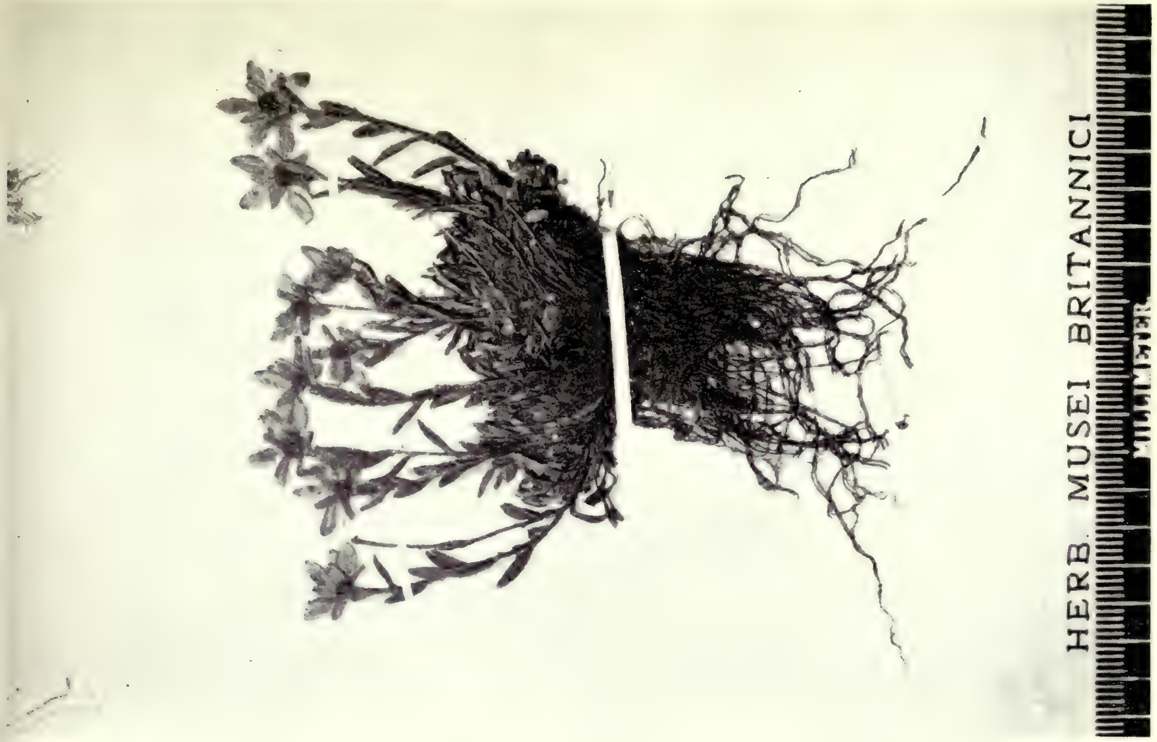

HERB. MUSEI BRITANNICI
MILLIMETER

B. Holotype of *Saxifraga sphaeradena* H. Sm. subsp. *sphaeradena*

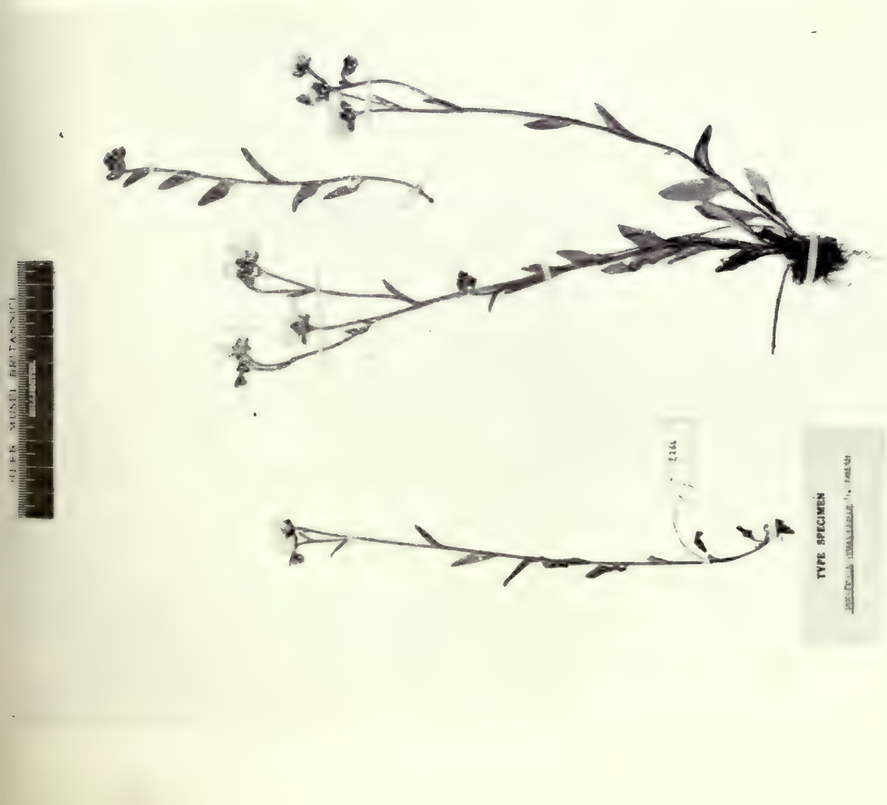
PLATE 16

A. *Saxifraga namdoensis* H. Sm.

B. *Saxifraga montanella* H. Sm.


HERB. MUSEI BRITANNICI
MILLIMETER

B. Holotype of *Saxifraga montanella* H. Sm.

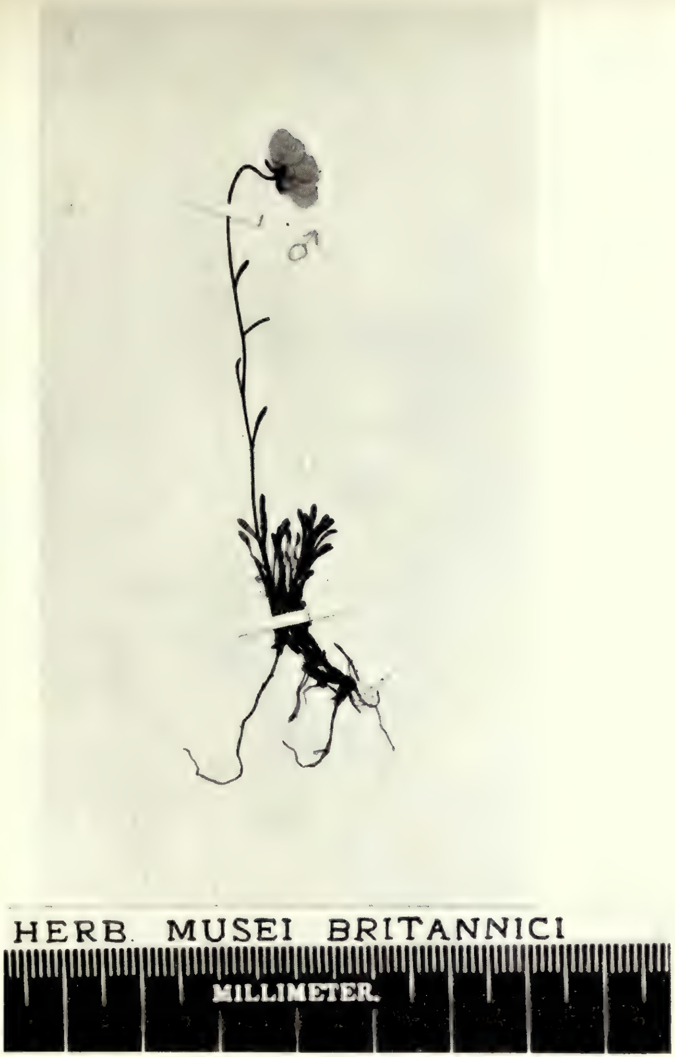

HERB. MUSEI BRITANNICI
TYPE SPECIMEN
FLORA OF NEPAL

A. Holotype of *Saxifraga namdoensis* H. Sm.

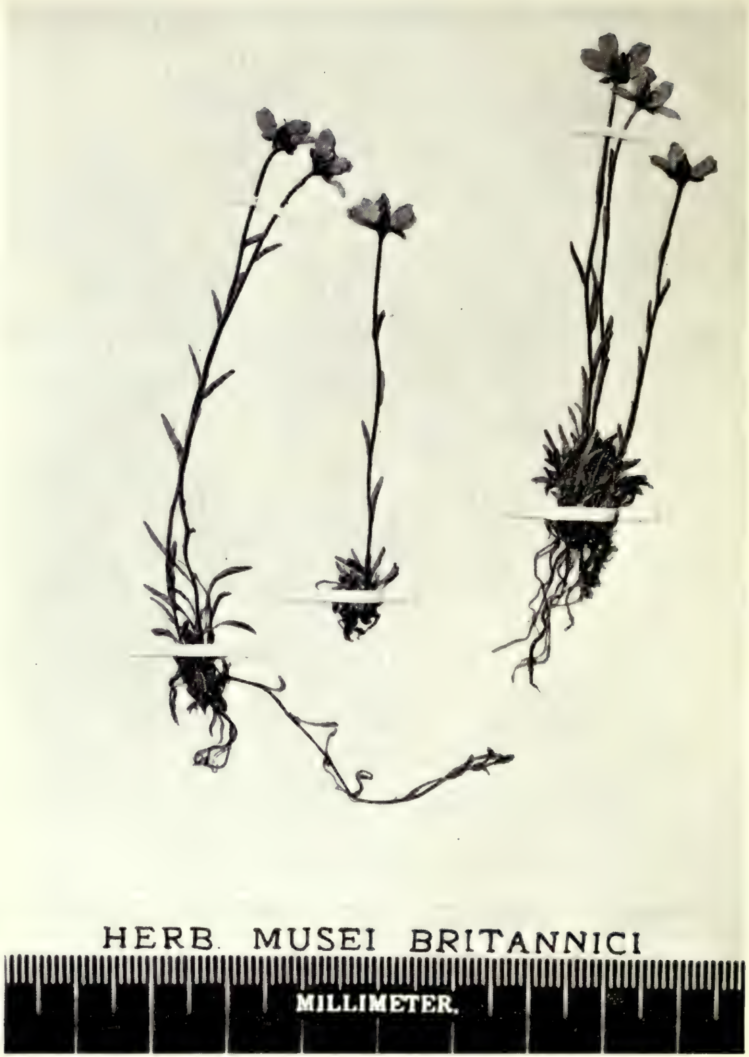
PLATE 17

A. *Saxifraga lepida* H. Sm.

B. *Saxifraga lepidostolonosa* H. Sm.


HERB. MUSEI BRITANNICI
MILLIMETER.

A. Holotype of *Saxifraga lepida* H. Sm.

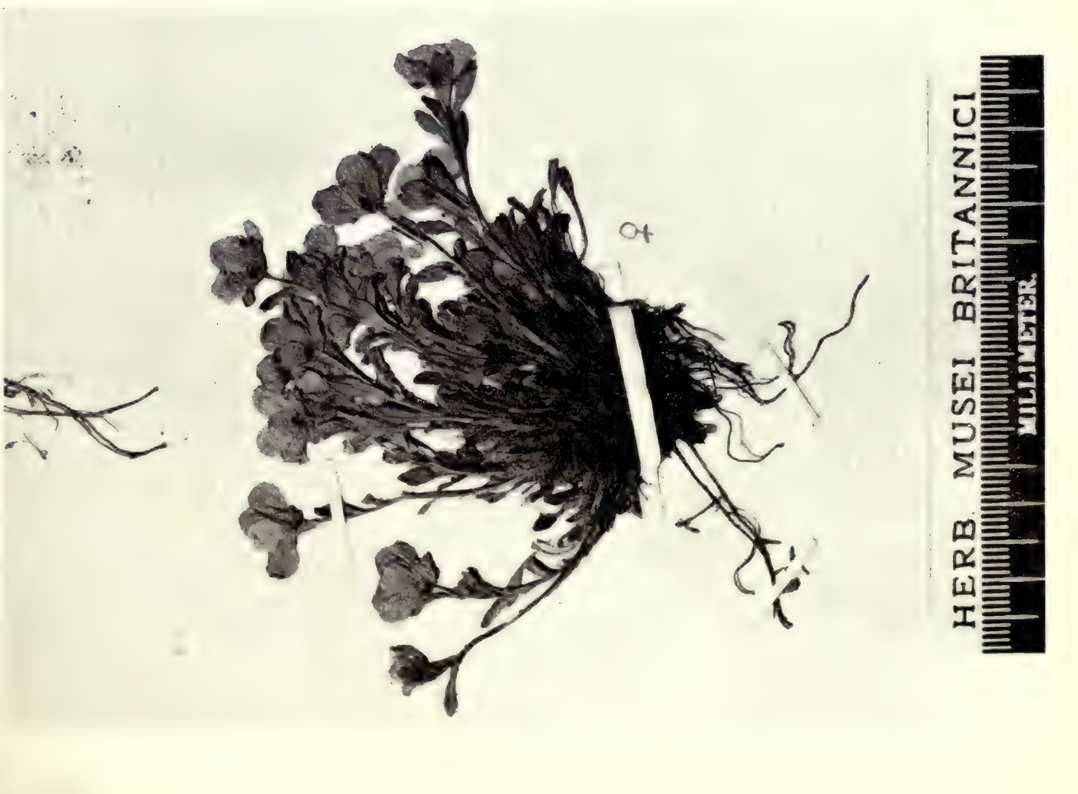

HERB. MUSEI BRITANNICI
MILLIMETER.

B. Holotype of *Saxifraga lepidostolonosa* H. Sm.

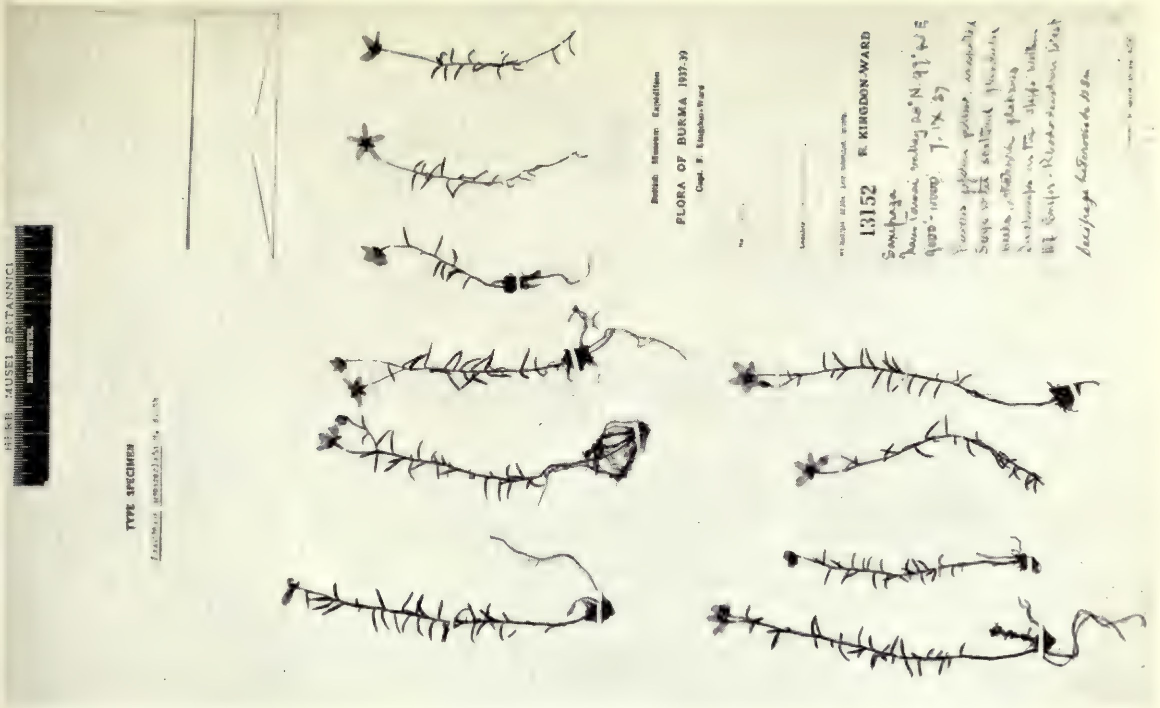
PLATE 18

A. *Saxifraga glabricaulis* H. Sm.

B. *Saxifraga heteroclada* H. Sm. var. *heteroclada*


HERB. MUSEI BRITANNICI
MILLIMETER.
♀

A. Holotype of *Saxifraga glabricaulis* H. Sm.

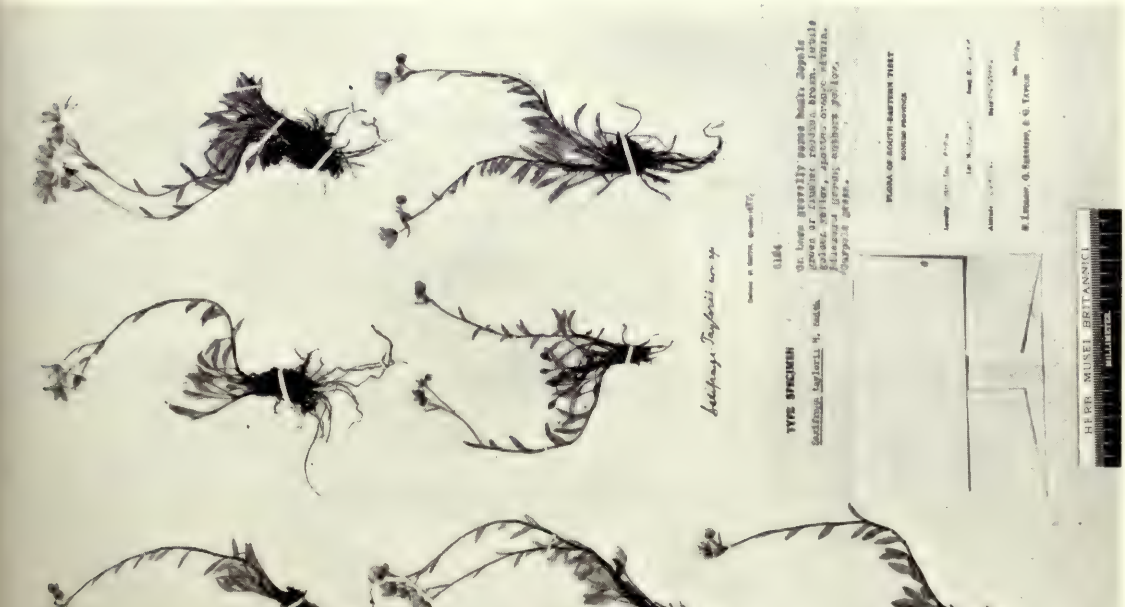

HERB. MUSEI BRITANNICI
MILLIMETER.
TYPE SPECIMEN
British Museum Expedition
FLORA OF BURMA 1937-39
Capt. F. Kingdon-Ward
13152
F. KINGDON-WARD
Saxifraga

B. Holotype of *Saxifraga heteroclada* H. Sm. var. *heteroclada*

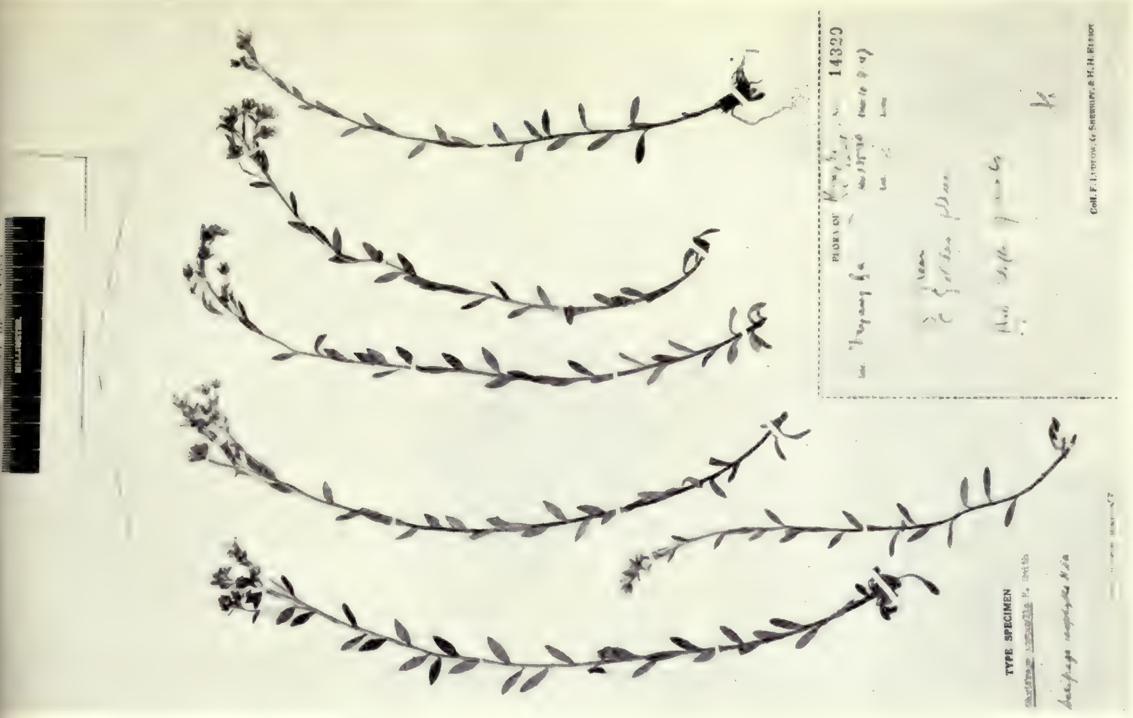
PLATE 19

A. *Saxifraga taylorii* H. Sm.

B. *Saxifraga isophylla* H. Sm.


TYPE SPECIMEN
Saxifraga taylorii H. Smith
FLORA OF SOUTH-EASTERN TIBET
KONGBO PROVINCE
HERB. MUSEI BRITANNICI

A. Holotype of *Saxifraga taylorii* H. Sm.

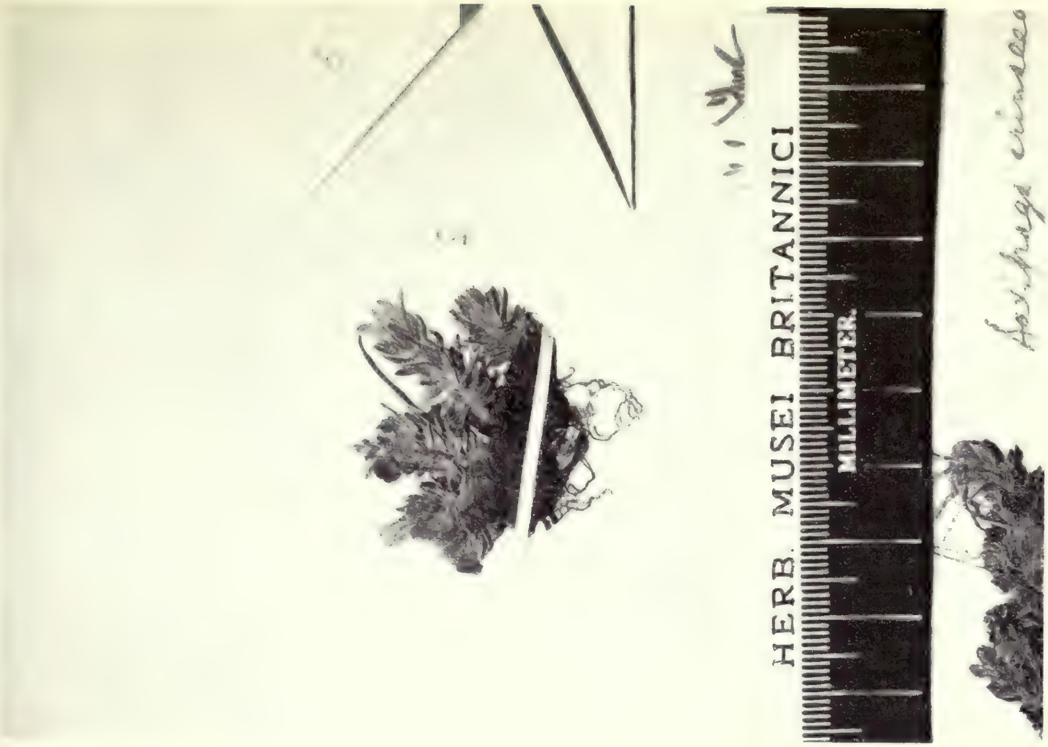

TYPE SPECIMEN
Saxifraga isophylla H. Smith
14329
HERB. MUSEI BRITANNICI

B. Holotype of *Saxifraga isophylla* H. Sm.

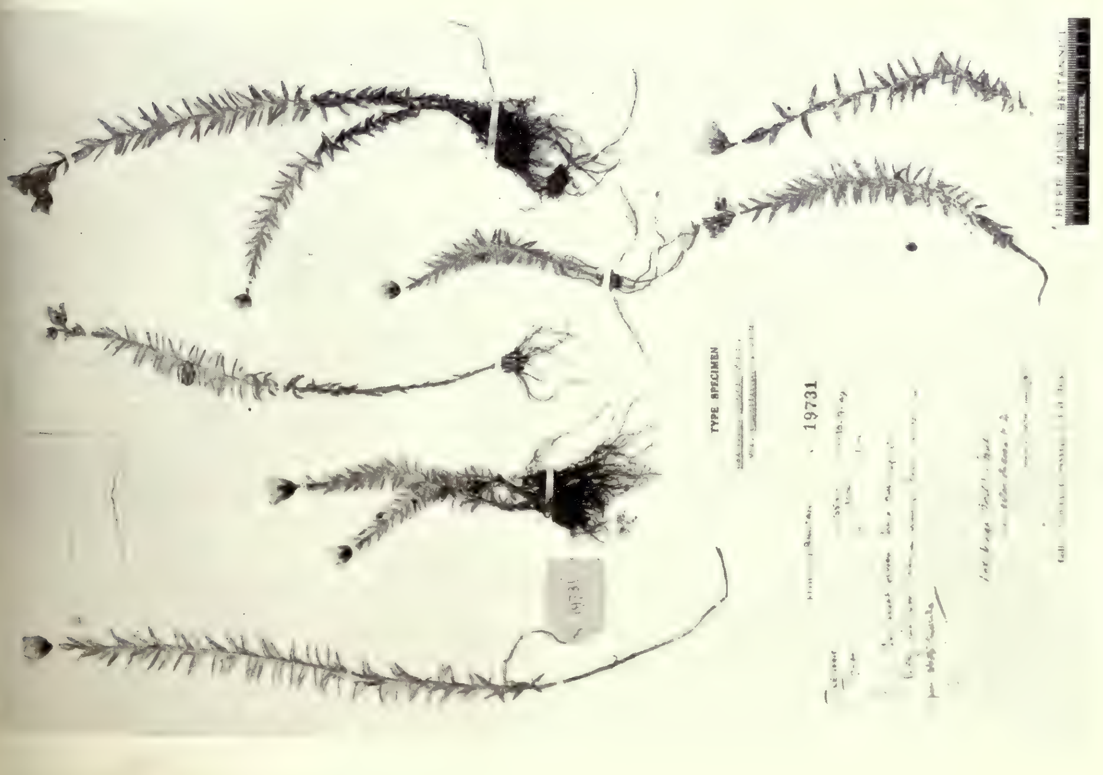
PLATE 20

A. *Saxifraga gouldii* var. *eglandulosa* H. Sm.

B. *Saxifraga erinacea* H. Sm.


HERB. MUSEI BRITANNICI
MILLIMETER
Saxifraga erinacea

B. Holotype of *Saxifraga erinacea* H. Sm.

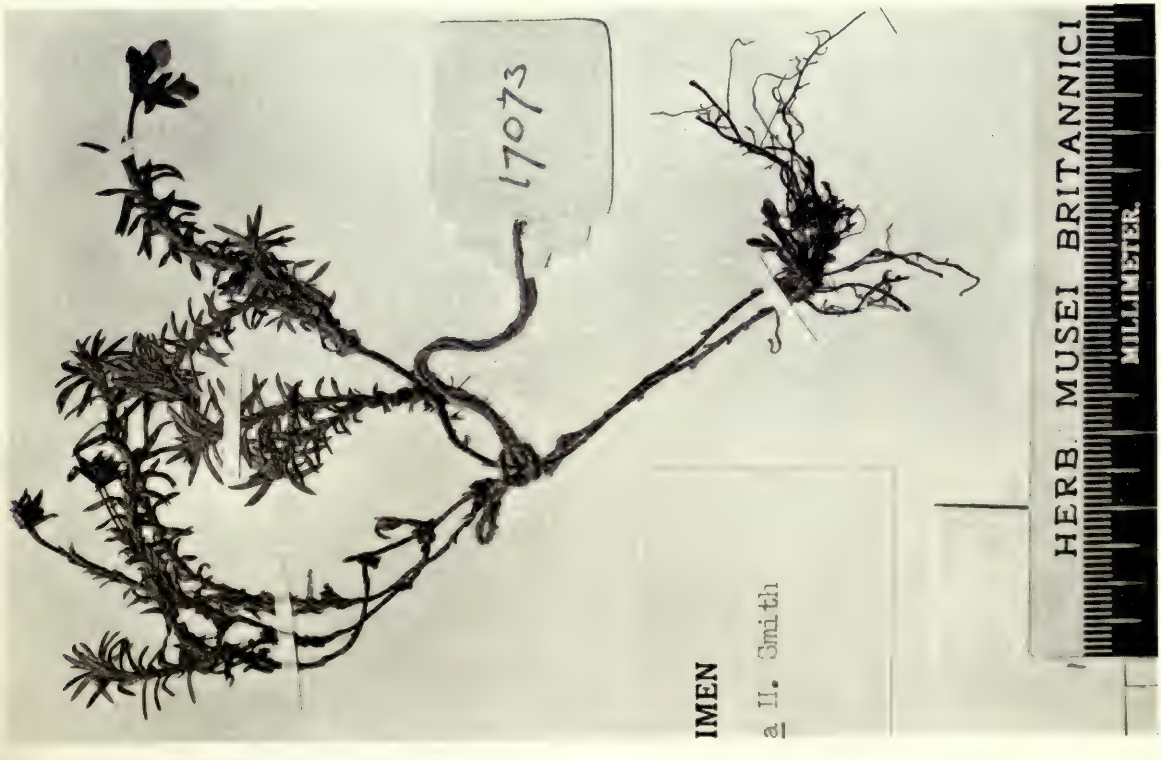

TYPE SPECIMEN
19731
19731
HERB. MUSEI BRITANNICI
MILLIMETER

A. Holotype of *Saxifraga gouldii* var. *eglandulosa* H. Sm.

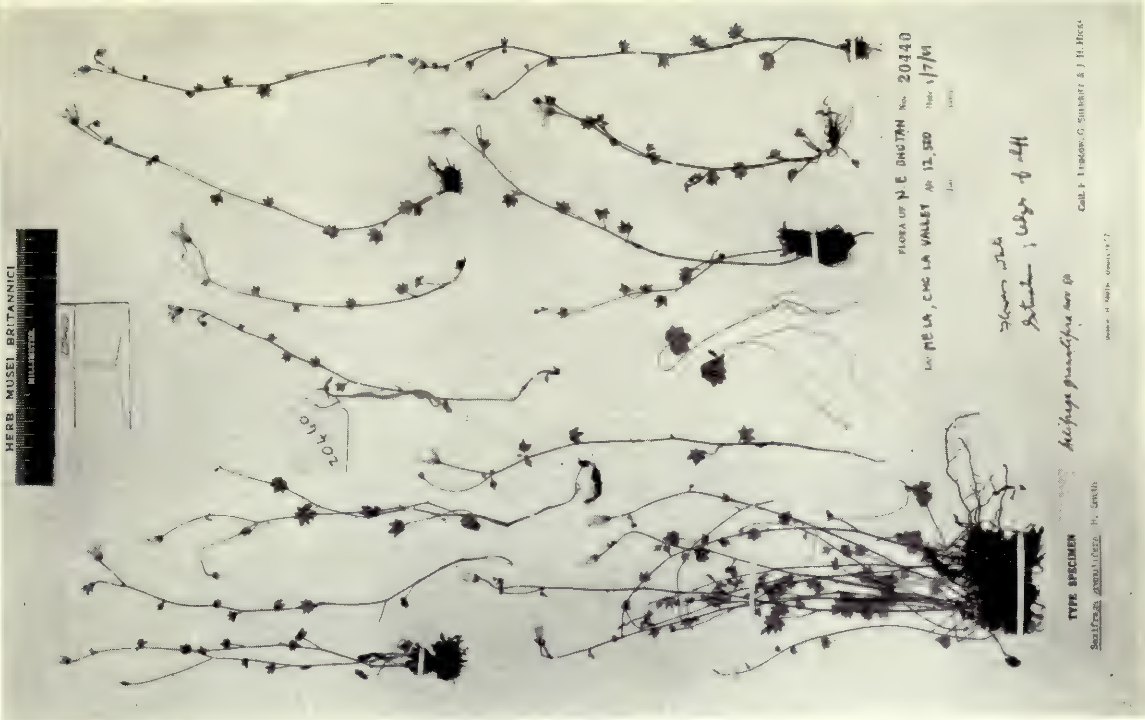
PLATE 21

A. *Saxifraga serrula* H. Sm.

B. *Saxifraga granulifera* H. Sm.


HERB. MUSEI BRITANNICI
MILLIMETER.
17073
IMEN
a H. Smith

A. Holotype of *Saxifraga serrula* H. Sm.


HERB. MUSEI BRITANNICI
MILLIMETER.
20440
FLORA OF N.E. BHUTAN No. 20440
TYPE SPECIMEN
Saxifraga granulifera H. Smith

B. Holotype of *Saxifraga granulifera* H. Sm.

B.M.
A.
O.

NEW SPECIES OF *TARAXACUM* FROM THE HIMALAYAN REGION

BRITISH MUSEUM
10 FEB 1961
NATURAL HISTORY

J. L. VAN SOEST

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 10
LONDON: 1961

NEW SPECIES OF *TARAXACUM* FROM THE HIMALAYAN REGION

BY

J. L. VAN SOEST

(The Hague)

BRITISH MUSEUM
10 FEB 1961
NATURAL HISTORY

Pp. 261–273 ; *Plates* 22–29

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 10
LONDON : 1961

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 10 of the Botany series.

© Trustees of the British Museum, 1961

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued February 1961 *Price Ten Shillings*

NEW SPECIES OF *TARAXACUM* FROM THE HIMALAYAN REGION

By J. L. VAN SOEST

VERY little is known of the various forms of the genus *Taraxacum* Weber that occur in Central Asia, and from the Himalaya in particular the material available is so scanty that it is even difficult to assess properly the various sections of the genus which are represented there.

About twenty very complex species from the Himalayan region have been enumerated by Handel-Mazzetti in his *Monographie der Gattung Taraxacum* (1907), but many of these would be regarded by Scandinavian botanists, like Dahlstedt and Haglund, as groups of species rather than as species. Moreover, Handel-Mazzetti erroneously recorded from the Himalayan region several of these complex species which are distributed in Europe and the Near East but do not penetrate so far into Asia.

No other general treatment of Himalayan *Taraxacum* exists. Dahlstedt (in Act. Hort. Gothoburg. ii : 143–184 (1926)) has, however, described a number of Chinese species which extend into the Himalayan region, and Haglund has recorded several species, including five new ones, in C. Persson's list of plants from East Turkestan and Kashmir (in Bot. Notis. 1938 : 307–317 (1938)). It may be hazardous to describe species as new when only a few specimens are available, especially when such specimens are from one locality only. Nevertheless, with a certain amount of hesitation, I venture to publish the following sixteen new species, and I am sure that others will be discovered when additional material becomes available from the region. One of the new species is from Chitral, three from Kashmir, four from Nepal, one from Bhutan, six from south-eastern Tibet, and one from north-western Yunnan to the east of the Himalaya.

I am most grateful to the Keeper of Botany, British Museum (Natural History), and the Directors of the Rijksherbarium, Leyden, and the Botanical Museum, Utrecht, for the loan of important material ; also to the staffs of the herbaria at the British Museum, Kew, Paris, Geneva and Stockholm for facilities to work at the genus. I also wish to thank Mr. Marks of the Rijksherbarium, Leyden, for photographing the type specimens ; the photographs are published here by courtesy of the Director of the Rijksherbarium.

Taraxacum bhutanicum Van Soest, sp. nov. (Plate 22.)

Planta parva c. 4–5 cm. alta, basi incrassata valde lanigera. *Folia* subnumerosa, decumbentia, laete gramineo-viridia, glabra vel subglabra, ambitu oblanceolata,

c. 3 cm. longa (petiolo brevi pallido incluso), c. 0·5–0·8 cm. lata, utrinsecus c. 3-lobata; lobi laterales triangulares, acuti, plerumque plus minusve retroversi, dorso denticulati vel brevissime dentati; lobus terminalis triangularis vel hastatus, plerumque integer vel dentatus raro subincisus, lobulis basis subelongatis subacutis vel subobtusis. *Scapi* 1–3, breves, araneosi. *Involucrum* mediocre c. 13 mm. longum et 12 mm. latum, viride; squamae exteriores laxe appressae, lanceolatae vel ovatae, acuminatae, c. 6 mm. longae, inferne latissime pallide marginatae, supernae purpureae, inconspicue callosae vel laeves; squamae interiores late lineares, membranaceo-marginatae, apice purpurascentes. *Calathium* planum radians ad 2·5 cm. diam.; ligulae luteae, marginales extus stria pallide cano-violacea notatae; antherae vacuae; styli et stigmata plus minusve sordide lutea. *Floret* verno. *Achenium* (maturum adhuc ignotum) rostratum; pappus albus.

BHUTAN: Ha, 2,700 m.; on grassy swards; 7 Apr. 1949, *Ludlow, Sherriff & Hicks 16020* (holotype in Herb. Brit. Mus.).

T. bhutanicum probably belongs to Handel-Mazzetti's group *Parvula*, but only an examination of ripe achenes can confirm this. It differs from *T. parvulum* DC. (included under *T. dissectum* (Ledeb.) Ledeb. by Handel-Mazzetti) by the dentate lateral lobes of the leaves and by the earlier flowering period; and from *T. dissectum* (*sensu stricto*) by the larger flower-heads and by the broader and more pronounced margin of the outer involucral bracts. From both these species *T. bhutanicum* can further be distinguished by the darker yellow flowers and by the lack of pollen.

Taraxacum chitralense Van Soest, sp. nov.

Planta gracilis 4–10 cm. alta, basi fragmentis foliorum vetustorum incrassata, inferne glabra. *Folia* laete gramineo-viridia nervo mediano pallido, petiolo roseo subalato; folia exteriora ambitu oblanceolata vel lingulata, obtusiuscula, ad 10 cm. longa, integra vel breviter dentata; folia interiora utrinsecus c. 3-lobata; lobi laterales ad 3 mm. longi, subacuti, patentes, integri; lobus terminalis elongatus, subobtusus. *Scapi* ad 5, foliis subaequilongi, araneosi. *Involucrum* parvum vel mediocre ad 10 mm. longum et 12 mm. latum, pallide viride; squamae exteriores laxe appressae, ovatae, ad 5 mm. longae et 4 mm. latae, pallidae, apice violaceae, breviter cornutae; squamae interiores lineares, virides, apice violaceae, corniculatae. *Calathium* paulo radians ad 1·5 cm. diam., laete luteum; ligulae marginales planae, extus stria cano-violacea notatae; antherae polline carentes; styli et stigmata fuscescentia. *Floret* aestate. *Achenium* stramineum, 3 mm. longum (pyramide exclusa), superne spinulosum, ceterum laeve, in pyramidem conicam 0·6 mm. longam subsensim abiens; rostrum c. 3 mm. longum; pappus albus, 5 mm. longus.

PAKISTAN: Chitral, Gohkir, 3,000 m.; on edge of bog; 12 June 1958, *Bowes Lyon 898* (holotype in Herb. Brit. Mus.).

This is closely allied to *T. nepalense* Van Soest, which, however, has a densely hairy base, longer involucral bracts (the outer ones up to 7 mm.), pink and purple colour on the outside of the flowers, and a longer pyramid on the achene (2 mm.) with a longer beak (c. 5 mm.).

In leaf form *T. chitralense* resembles *T. sherriffii* Van Soest and *T. sinense* Dahlst.

T. sherriffii differs in its more or less hairy base, pale petioles, dark-coloured involucre, yellow stigmas, and lack of horns on the inner involucral bracts. *T. sinense* differs in many respects, e.g. the absence of horns on the bracts, the darker yellow flowers, and the longer pyramid and rostrum of the achenes.

Taraxacum dasypodum Van Soest, sp. nov.

Planta mediocris 5–6 cm. alta, basi fragmentis foliorum vetustorum plus minusve incrassata, inferne dense longe araneoso-pilosa. *Folia* decumbentia, laete gramineo-viridia vel subcanescentia nervo mediano pallido, glabrescentia, ambitu oblanceolata, ad 7 cm. longa (petiolo pallido alato incluso) et 1·8 cm. lata, utrinsecus 2–3-lobata; lobi laterales breves ad 5 mm. longi, deltoidei vel triangulares, subacuti, subretroversi, integri; lobus terminalis sat magnus, longe hastatus, subobtusus, integer vel 1-dentatus. *Scapi* 2–3, foliis paulo breviores, araneosi. *Involucrum* mediocre 11 mm. longum et ad 13 mm. latum, pallide viride; squamae exteriores appressae, ovatae vel ovato-lanceolatae, 3–5 mm. longae, ad 2 mm. latae, inconspicue late albo-marginatae, apice corniculis violaceis instructae; squamae interiores lanceolatae, ad 2–2·5 mm. latae, subanguste pallide marginatae, apice plus minusve violaceae, callosae. *Calathium* paulo radians ad 1·8 cm. diam.; ligulae luteae, marginales planae extus roseolae apice plus minusve purpureae; antherae polline carentes; styli et stigmata lutea. *Floret* verno. *Achenium* obscure stramineum, c. 5 mm. longum, laeve, in rostrum c. 3–4 mm. longum inconspicue sensim abiens; pappus albus, 5 mm. longus.

CHINA: N.W. Yunnan, base of eastern flank of Lichiang range, 27° 10′ N., 2,700 m.; in dry stony pastureland; May 1906, *Forrest 2080* (holotype in Herb. Brit. Mus.).

This species is allied to *T. nepalense* Van Soest, from which it differs by the lighter-coloured involucre, the pale pink colour of the outer side of the ligules, and, especially, the form of the achenes. The achene is smooth and passes, via an elongated pyramid, almost imperceptibily into the beak; and in this character *T. dasypodum* shows relationship with *T. brevirostre* Hand.-Mazz. which belongs to the *Parvula* group according to Handel-Mazzetti. *T. dasypodum* differs from *T. brevirostre*, however, by the longer scapes, which exceed the leaves, by the pale pink (instead of brownish-purple) colour on the outside of the ligules, and by the form of the leaves; *T. brevirostre* has linear leaves with short linear spreading side lobes and with an elongated terminal lobe, whereas *T. dasypodum* has broader leaves with a broader central lamina and with short deltoid slightly recurved side lobes.

T. dasypodum is related also to *T. stevenii* (Spreng.) DC., which, however, has entire leaves, bicolorous outer involucral bracts, slightly tuberculate achenes, and a more glabrous plant base. This base is thick and therefore resembles that of species of the *Parvula* group.

Taraxacum forrestii Van Soest, sp. nov. (Plate 23.)

Planta robusta sed humilis c. 5–7 cm. alta, basi valde incrassata plus minusve araneoso-pilosa. *Folia* numerosa, decumbentia, gramineo-viridia nervo mediano pallido, araneosa, ad 6 cm. longa (petiolo brevi colorato incluso) et 1·8 cm. lata;

folia exteriora utrinsecus 6-lobata, lobis lateralibus triangularibus patentibus vel subretroversis integris vel denticulatis, lobo terminali plus minusve deltoideo obtuso ; folia interiora utrinsecus 6–8-lobata ; lobi laterales triangulares, acuti, patentes vel paulo (inferiores saepe distincte) retroversi, saepe dorso fissi vel dentati, margine inferiore saepe subbreviter dentati, interlobiis subnullis ; lobus terminalis brevis, deltoideus (lobulis basis et apicis subelongatis acutis) vel subelongato-hamatus vel ovato-hastatus dentatus. *Scapi* 2–3, foliis breviores, araneosi. *Involucrum* crassum 16 mm. longum et 18 mm. latum, sordide viride ; squamae exteriores laxe appressae, ovatae (vel interiores lanceolatae), ad 7 mm. longae et 4 mm. latae, rufo-virides, inconspicue late pallide marginatae, reticulato-venulosae, apice corniculatae ; squamae interiores late lineares, ad 2 mm. latae, atro-virides, membranaceo-marginatae, plus minusve callosae. *Calathium* radians planum ad 3·5 cm. diam. ; ligulae luteae, marginales planae extus stria cano-purpurea notatae ; antherae polliniferae ; styli et stigmata nigra. *Floret* aestate. *Achenium* (maturum adhuc ignotum) rostratum ; pappus albus.

INDIA : Uttar Pradesh, Kumaun, between Balch and Kyo Pass, 4,500–4,800 m., Aug. 1929, *Benham* (Herb. Brit. Mus.).

S.E. TIBET : Khargurpu, Mekong-Salween divide, 28° 25′ N., 4,200 m. ; in open stony pasture ; July 1917, *Forrest 14424* (holotype in Herb. Brit. Mus. ; isotype in Herb. Kew).

This species appears to be related to Dahlstedt's group *Mongolica* because of the distinct network of veins on the outer involucral bracts. It is also allied, on account of the dark styles and stigmas and the dark involucre, to *T. tibetanum* Hand.-Mazz. The *Mongolica* are not known from India and Tibet.

Taraxacum glaucophyllum Van Soest, sp. nov. (Plate 24.)

Planta gracilis ad 20 cm. alta, glabra, collo fragmentis foliorum persistentibus obscure squamato ; radix crassa. *Folia* glauca nervo mediano pallido, late linearia vel lineari-oblanceolata, basin versus longius angustata, obtusa, c. 12 cm. longa (petiolo purpureo incluso), ad 1 cm. lata, minute denticulata vel sparse breviter dentata vel sublonge patenti-dentata dentibus ad 3–4 mm. longis lanceolatis subobtusis, parte terminali (3 cm. longa) integra. *Involucrum* ad 15 mm. latum, atro-viride ; squamae exteriores lanceolatae, c. 6 mm. longae, ad 1·5 mm. latae, late albo- vel roseolo-marginatae, grosse deltoideo-corniculatae ; squamae interiores late lineares, 12 mm. longae, albo-marginatae, apice purpureae, corniculatae vel callosae. *Calathium* paulo radians, subclausum ; ligulae tubulosae, 16 mm. longae, pallide luteae, exteriores plus minusve purpureae ; antherae polliniferae ; styli et stigmata lutea. *Floret* aestate. *Achenium* stramineum, obovoideum, 3 mm. longum (pyramide exclusa), c. 1·3 mm. latum, cristato-spinulosum, basi laeve, superne minute spinulosum, in pyramidem conicam 1 mm. longam subabrupte abiens ; rostrum 3·5 mm. longum ; pappus albus, 6 mm. longus.

S.E. TIBET : Shugden Gompa, Nagong, 3,900–4,200 m. ; on alpine turf slopes, stony ground ; 1 Sept. 1933, *Kingdon-Ward 10803* (holotype in Herb. Brit. Mus.).

This resembles *T. stenolepium* Hand.-Mazz., but the latter has shorter scapes, smaller horns on the involucral bracts, and ligules greyish on the outside. The achenes are clearly different: in *T. glaucophyllum* the pyramid is much longer and distinctly marked off from the more spinulose body of the achene. The achene of *T. glaucophyllum* is similar to that of *T. dealbatum* Hand.-Mazz. as figured by Handel-Mazzetti, Monogr. Gatt. Tarax.: t. 1 fig. 9 *b* (1907).

Taraxacum himalaicum Van Soest, sp. nov.

Planta mediocris 4–12 cm. alta, basi fragmentis foliorum vetustorum incrassata, inferne plus minusve araneoso-pilosa. *Folia* paulo canescentia, glabra, petiolo pallido vel pallide roseolo alato vel subalato; folia exteriora ambitu oblanceolata vel lingulata, retroverso-denticulata vel dentata vel breviter deltoideo-lobata; folia interiora utrinsecus 2–4-lobata; lobi laterales 3–4 mm. longi, deltoidei vel triangulares, obtusi vel subobtusi raro subacuti, dorso convexi interdum denticulati, margine inferiore integri, interlobiis 3–5 mm. latis; lobus terminalis ad 15 mm. longus, obtusus vel subobtusus, subinteger. *Scapi* folia aequantes vel saepe breviter superantes, sub involucro araneosi. *Involucrum* ad 12 mm. longum, 5–6 mm. latum, basi subtruncatum, pallide viride; squamae exteriores plus minusve appressae, lanceolatae, ad 6 mm. longae, 3 mm. latae, pallide marginatae, apice purpureae, callosae; squamae interiores late lineares, membranaceo-marginatae, apice purpureae, callosae. *Calathium* subradians ad 2 cm. diam., (pallide?) luteum; ligulae marginales planae, extus stria cano-violacea notatae; antherae polliniferae; styli et stigmata lutea. *Floret* verno. *Achenium* aurantiacum, c. 3·5 mm. longum (pyramide exclusa), superne spinulosum ceterum laeve, in pyramidem conicam c. 1·5 mm. longam sensim abiens; rostrum 5–6 mm. longum; pappus niveus, 6–7 mm. longus.

NEPAL: Jumla, 2,250 m.; on sunny grassy slopes; 4 May 1952, *Polunin, Sykes & Williams 900* (Herb. Brit. Mus.) (entire-leaved form). Hills north of Pokhara, 2,250 m.; on dry bank; 17 Apr. 1954, *Stainton, Sykes & Williams 4848* (holotype in Herb. Brit. Mus.). Near Gujakhani, 2,850 m.; on grassy slopes on ridge; 12 June 1954, *Stainton, Sykes & Williams 3090* (Herb. Brit. Mus.). Bhadauri, east of Kusma, 1,500 m.; on rock and grass bank near cultivation; 17 Apr. 1954, *Stainton, Sykes & Williams 15* (Herb. Brit. Mus.).

This is closely allied to *T. indicum* Hand.-Mazz. but differs from it by the orange achenes and the more appressed involucral bracts. The stigmas of *T. himalaicum* are clear yellow.

Taraxacum hooftii Van Soest, sp. nov. (Plate 25.)

Planta mediocris gracilis 10–15 cm. alta, basi glabra; radix tenuis. *Folia* laete griseo-viridia, glabra, ambitu oblanceolata, in petiolum pallidum valde decurrentia, plus minusve irregulariter dentata vel lobata; lobi laterales breves vel sat longi, triangulares, acuti, pro maxima parte retroversi; lobus terminalis haud bene limitatus, acutus vel subacutus. *Scapi* florendi tempore foliis longiores, sub involucro araneoso-lanigeri, ceterum glabri. *Involucrum* 14 mm. longum, basi rotundatum; squamae exteriores laxe appressae, plus minusve ovatae vel ovato-lanceolatae, longe acuminatae, pallide virides vel roseolae, sublate albido-marginatae, reticulato-venulosae, glabrae, apice purpureae ; squamae interiores exterioribus duplo longiores, late lineares, apice atro-violaceae. *Calathium* c. 2·5 cm. diam. ; ligulae laete luteae, marginales extus stria sordide cano-violacea notatae ; antherae polliniferae ; styli et stigmata lutea. *Floret* aestate. *Achenium* fusco-stramineum, 3 mm. longum (pyramide exclusa), superne sat late et breviter spinulosum, in pyramidem c. 0·8 mm. longam cylindricam abrupte abiens ; rostrum album, 6–7 mm. longum ; pappus niveus, 5–6 mm. longus.

KASHMIR : Karakoram, Gircha, 2,500 m., 8 June 1925, *Visser-Hooft 2* (holotype in Herb. Bot. Mus. Utrecht). Karakoram, Nubra valley, 3,200 m., 2 June 1929, *Visser-Hooft 55* (Herb. Bot. Mus. Utrecht).

Possibly plants collected by Appleton in the Pamir and Tian Shan in 1906 (Herb. Kew) belong to this species.

In leaf form there is some resemblance between this species and *T. platypecidum* Diels, but they differ in many other respects. According to Dahlstedt (in Act. Hort. Gothoburg. ii : 145 (1926)) *T. platypecidum* belongs to his group *Calanthodia*, and the same may perhaps be true of *T. hooftii*.

Taraxacum karakoricum Van Soest, sp. nov. (Plate 26.)

Planta mediocris 5–8 cm. alta, collo glabro. *Folia* terrae appressa, laete viridia nervo mediano ut petiolo alato pallido, glabra, ambitu oblanceolata, ad 7 cm. longa, utrinsecus c. 3-lobata ; lobi laterales breves, late triangulares vel deltoidei, obtusi vel subobtusi, subintegri ; lobus terminalis parvus, brevis, interdum inaequilaterus, plus minusve triangulari-rhomboideus. *Scapi* ad 3, parce (sub involucro dense) araneoso-pilosi. *Involucrum* ad 15 mm. longum, basi inconspicue truncatum, nitide viride ; squamae exteriores laxe appressae vel patentes, lanceolatae, ad 7 mm. longae, late albo- vel virescenti-marginatae, inconspicue reticulato-venulosae, margine interdum erosae, apice longe cornutae ; squamae interiores callosae vel corniculatae. *Calathium* radians ad 3·5 cm. diam. ; ligulae luteae, marginales extus stria rufo-purpurea notatae ; antherae polliniferae ; styli et stigmata leviter fuscescentia. *Floret* aestate. *Achenium* (maturum adhuc ignotum) rostratum, superne spinulosum ; pappus albus.

KASHMIR : Karakoram, Lashi valley, 4,800 m. ; in humid pasture ; 8 Aug. 1922, *Visser-Hooft 40* (holotype in Herb. Bot. Mus. Utrecht).

This belongs to Dahlstedt's group *Ceratophora*.

Taraxacum kashmirense Van Soest, sp. nov.

Planta mediocris ad 20 cm. alta, collo subglabro. *Folia* obscure viridia, subglabra, sublobata vel patenti- vel retroverso-dentata, lobis lateralibus et dentibus acutissimis. *Scapi* florendi tempore foliis subaequilongi, sub involucro subaraneosi. *Involucrum* atro-viride (in sicco nigrum) ; squamae pro parte subcallosae, exteriores laxe appressae lanceolatae vel pro parte lineares, interiores late lineares. *Calathium* c. 1·5 cm. diam. ; ligulae luteae, marginales extus stria fusco-violacea notatae ;

antherae polliniferae ; styli et stigmata subnigra (in sicco nigra). *Floret* aestate. *Achenium* maturum adhuc ignotum.

KASHMIR : Vishansar, 3,600 m. ; on open ground ; 17 Aug. 1940, *Pinfold 373* (holotype in Herb. Brit. Mus.).

This species differs from *T. tibetanum* Hand.-Mazz., with which it is closely allied, by the smaller flower-heads with narrow outer involucral bracts ; the leaves are sublobate or only dentate, with spreading or retroverse teeth.

Taraxacum lanigerum Van Soest, sp. nov. (Plate 27.)

Planta robusta sed humilis 7–9 cm. alta, basi fragmentis foliorum vetustorum valde incrassata, inferne longe araneoso-pilosa pro parte lanigera. *Folia* numerosa, laete gramineo-viridia, supra purpureo-maculata, utrinque araneoso-pilosa inferne sublanigera, ad 10 cm. longa et 3 cm. lata, utrinsecus 5-lobata, petiolo badio-purpureo subalato vel subangusto ; lobi laterales hamati vel triangulares vel falcati, summo elongati subobtusi vel subacuti, retroversi, dorso plerumque valde convexi dentati, interlobiis sat brevibus (3–5 mm.) ad 5 mm. latis saepe dentatis ; lobus terminalis subhastatus, lobulis basis saepe valde elongatis retroversis, lobulo apicis obtuso vel subacuto. *Scapi* 2–4, araneosi, sub involucro dense longe araneoso-pilosi. *Involucrum* magnum crassiusculum 19 mm. longum et 25 mm. latum, subnigrum; squamae exteriores appressae, lanceolatae, 12 mm. longae, 2·5 mm. latae, subanguste albo- vel viridi-marginatae, corniculatae, superne et in margine araneoso-pilosae ; squamae interiores late lineares, late marginatae, callosae, araneoso-pilosae. *Calathium* planum radians ad 4 cm. diam. ; ligulae luteae, marginales extus stria subnigra ornatae ; antherae polliniferae ; styli et stigmata nigra. *Floret* aestate. *Achenium* maturum adhuc ignotum ; pappus albus.

S.E. TIBET : Ata Kang La, Nagong, 3,900–4,200 m. ; in pastures ; 16 July 1933, *Kingdon-Ward 10596* (holotype in Herb. Brit. Mus.).

This species is related to *T. lugubre* Dahlst., found in western China, differing from it by the dark-spotted leaves with still more elongated side lobes and dark purple petiole, by the shorter scapes, and by the larger involucre (only 16 mm. long in *T. lugubre*) with lanceolate (instead of ovate) outer bracts provided with small horns.

Like most plants of its group (*Calanthodia* Dahlst.) it is a beautiful one ; the yellow flowers are in splendid contrast to the black involucre and the very dark styles.

Taraxacum ludlowii Van Soest, sp. nov. (Plate 28.)

Planta ad 35 cm. alta, basi rubra glabra. *Folia* erecta, gramineo-viridia nervo mediano lucide albo vel pro parte rubescenti, glabra, ambitu lingulata, ad 20 cm. longa (petiolo excluso), utrinsecus c. 6-lobata, petiolo rubro-violaceo angusto ad 10 cm. longo ; lobi laterales ad 12 mm. longi, angusti, plus minusve falcati, acutissimi, patentes vel erecto-patentes vel retroversi, integri vel dorso 1-dentati, interlobiis sat longis (ad 20 mm.) et c. 6–10 mm. latis integris ; lobus terminalis ad 35 mm. longus, elongato-hastatus, acutus, lobulis basis angustis acutis patentibus vel oblique patentibus. *Scapi* florendi tempore foliis longiores, subcrassi, inferne purpurei, sub involucro araneosi. *Involucrum* 15 mm. longum, atro-viride ; squamae exteriores lanceolatae, summo lineares valde attenuatae, ad 10 mm. longae, inconspicue anguste albo-marginatae, pro parte corniculatae vel cornutae ; squamae interiores late membranaceo-marginatae. *Calathium* radians planum 4 cm. diam. ; ligulae saturate luteae, marginales planae extus stria purpurea vel roseola notatae ; antherae polliniferae ; styli sordide lutei, stigmatibus fusco-virescentibus. *Floret* aestate. *Achenium* maturum adhuc ignotum ; pappus sordide albus.

S.E. TIBET : Reting, 60 miles north of Lhasa, 4,200 m. ; on grassy hill slopes ; 30 July 1942, *Ludlow & Sherriff 8951* (holotype in Herb. Brit. Mus.). Vicinity of Lhasa, 3,900 m., July 1939, *Richardson 307* (Herb. Brit. Mus.).

T. ludlowii has in common with several species of Central Asia a certain shape of the leaves, e.g. *T. sinense* Dahlst., *T. cuspidatum* Dahlst. and *T. stenolepium* Hand.-Mazz. ; from these it differs by the long horns on the outer involucral bracts which themselves are longer and more elongated.

T. glaucophyllum Van Soest is closely allied to *T. ludlowii*, but it has clear yellow stigmas and a much more distinct margin to the outer involucral bracts ; furthermore, the terminal lobe of the leaves is obtuse in *T. glaucophyllum* and acute in *T. ludlowii*.

T. staticifolium Van Soest may also be related, but its leaves are linear and nearly entire, while the involucral bracts lack horns.

Taraxacum mucronulatum Van Soest, sp. nov.

Planta robusta ad 25 cm. alta, inferne glabra. *Folia* erecta, luteo-viridia, ad 20 cm. longa et 4 cm. lata, dentata (folia exteriora) vel sublobata vel utrinsecus 2–3-lobata, petiolo pallido paulo roseo-colorato alato ; lobi laterales triangulares, acuti, purpureo-mucronulati, patentes vel paulo retroversi, integri vel rare dorso denticulati vel 1-dentati, interlobiis latiusculis vulgo 5–15 mm. latis ; lobus terminalis longe deltoideus vel deltoideo-hastatus, acutus, mucronatus, integer vel interdum inciso-dentatus. *Scapi* ad 3, sub involucro araneosi. *Involucrum* cylindrico-ovoideum ad 20 mm. longum, c. 12 mm. latum, basi rotundatum ; squamae exteriores plus minusve appressae, ovato-lanceolatae, ad 8 mm. longae et 3 mm. latae, virides, inferne late albido- vel submembranaceo-marginatae ; squamae interiores late lineares, membranaceo-marginatae, omnes apice violaceae, callosae. *Calathium* submagnum ; ligulae marginales planae, c. 25 mm. longae, flavae (?), extus plus minusve roseolae et stria violacea notatae, summo purpureae ; antherae polline carentes ; styli lutei. *Floret* aestate. *Achenium* stramineum, c. 4 mm. longum (pyramide exclusa), superne breviter spinulosum, in pyramidem 1·5 mm. longam sensim abiens ; rostrum 7 mm. longum ; pappus albus, c. 7 mm. longus.

NEPAL : Chutta, S.E. of Jumla, 3,000 m. ; beside track ; 25 July 1952, *Polunin, Sykes & Williams 4912* (holotype in Herb. Brit. Mus.).

This tall-growing plant resembles in leaf form those of Dahlstedt's group *Vulgaria*, such as *T. alatum* Lindb. f. and *T. retroflexum* Lindb. f., but the flower-heads and achenes are very different, showing relationship to *T. dasypodum* Van Soest, *T. nepalense* Van Soest and *T. stenolepium* Hand.-Mazz. ; the outer involucral bracts

are ovate-lanceolate and have a broad white or often pink margin and a purple apex with more or less small horns.

The form of the achenes, which are shortly spinulose above, is characterized by a gradual elongation into a relatively long pyramid. In common with Dahlstedt's group *Vulgaria* the achene of *T. mucronulatum* has a long beak, measuring 7 mm. instead of 3–5 mm. as in *T. dasypodum*, *T. nepalense* and *T. stenolepium.*

Taraxacum nepalense Van Soest, sp. nov. (Plate 29.)

Planta gracilis ad 12 cm. alta, basi lanigera. *Folia* erecta, gramineo-viridia petiolo plus minusve roseolo, glabra, ambitu oblanceolata, 5–7 cm. longi, integra vel retroverse denticulata dentatave vel patenter lobata ; lobi laterales breves ad 4 mm. longi, acuti, integri. *Scapi* 1–3, araneoso-pilosi. *Involucrum* crassiusculum, viride ; squamae exteriores appressae, ovato-lanceolatae, 5–7 mm. longae, 3–4 mm. latae, late pallido-marginatae, nervo mediano viridi summo subnigro, corniculatae ; squamae interiores late lineares, membranaceo-marginatae, corniculatae, apice atro-virides. *Calathium* paulo radians ad 2·5 cm. diam. ; ligulae pallide luteae, marginales planae extus roseolae striaque purpurea ornatae ; antherae polline carentes ; styli et stigmata fuscescentia. *Floret* aestate. *Achenium* stramineum, c. 5·5 mm. longum (pyramide inclusa), superne spinulosum, ceterum rugosum, in pyramidem conicam 2 mm. longam sensim abiens ; rostrum breve c. 5 mm. longum ; pappus albus, 5 mm. longus.

NEPAL : Khaptar forest, 1 June 1929, *Bis Ram 505* (holotype in Herb. Brit. Mus.). Marsiandi valley, 3,390 m. ; on dry ground under big juniper trees ; 11 July 1950, *Lowndes 978* (Herb. Brit. Mus.) (styles more yellowish).

This species is allied to *T. porphyranthum* Boiss. ; both have purplish flowers and their leaf form is rather similar. In *T. porphyranthum*, however, the outer involucral bracts are narrowly margined, whereas in *T. nepalense* the green field of the bracts is nearly restricted to the median line. Moreover, the achenes of the two species differ considerably and the area of distribution of *T. porphyranthum* lies in western Asia.

T. nepalense is allied also to *T. hooftii* Van Soest, which has almost the same leaf form but differs from *T. nepalense* by its yellow flower-heads with larger involucral bracts.

Taraxacum pseudostenoceras Van Soest, sp. nov.

Folia laete viridia nervo mediano ut petiolo purpureo, glabrescentia ; folia exteriora subintegra ; folia interiora utrinsecus 2–4-lobata ; lobi laterales integri, magis retroversi. *Scapi* florendi tempore foliis subaequilongi. *Involucrum* c. 14 mm. longum, basi ovoideum ; squamae exteriores plurimae, subappressae, ovato-lanceolatae, in apicem protractae, submarginatae, longissime anguste cornutae; squamae interiores cornutae. *Calathium* radians c. 4 cm. diam. ; ligulae laete luteae, planae, extus stria rubro-purpurea notatae ; antherae polliniferae ; styli et stigmata sordide pallide lutea. *Floret* aestate. *Achenium* maturum adhuc ignotum.

NEPAL: Mustang, 4,500 m.; on open grass slopes; 5 Aug. 1954, *Stainton, Sykes & Williams 2189* (holotype in Herb. Brit. Mus.).

Although having a very different leaf form this new species is closely allied to *T. stenoceras* Dahlst., which it resembles especially in the long-horned involucral bracts. According to Dahlstedt (in Act. Hort. Gothoburg. ii: 166 (1926)) *T. stenoceras* belongs to his group *Ceratophora*, but he mentions a few striking differences from the more typical forms of this group, e.g. the very narrow outer bracts and the form of the long and narrow horns. I doubt whether *T. stenoceras* and *T. pseudostenoceras* really belong to this group.

Taraxacum sherriffii Van Soest, sp. nov.

Planta gracilis 10–12 cm. alta, basi fragmentis foliorum vetustorum incrassata, inferne plus minusve araneoso-pilosa. *Folia* paulo canescentia nervo mediano pallido, plus minusve araneoso-pilosa, ambitu lingulata, ad 15 cm. longa (petiolo incluso) et 1·8 cm. lata, petiolo pallido subangusto superne dentato in laminam sensim abienti; folia exteriora obtusa, subintegra vel utrinsecus c. 3-lobata, lobis deltoideis; folia interiora utrinsecus 5-lobata; lobi laterales angusti, lanceolati vel lineares, subobtusi, patentes, integri vel rare dorso 1-dentati, interlobiis sat longis (ad 15 mm.) et c. 3 mm. latis; lobus terminalis sat magnus, inaequilaterus, subobtusus, lobulis basis angustis patentibus vel subreflexis. *Scapi* 2–3, florendi tempore foliis subaequilongi, sub involucro araneoso-pilosi vel glabrescentes. *Involucrum* mediocre subcrassiusculum 11 mm. longum et 15 mm. latum, atro-viride; squamae exteriores appressae, lanceolatae, acuminatae, atro-virides, late albo- vel viridi-marginatae, cornutae; squamae interiores lineares, membranaceo-marginatae, laeves. *Calathium* paulo radians planum 2–2·5 cm. diam.; ligulae luteae, marginales planae extus stria cano-purpurea notatae; antherae polliniferae; styli et stigmata lutea. *Floret* verno. *Achenium* (maturum adhuc ignotum) rostratum; pappus sordide albus.

S.E. TIBET: Lhasa, 3,540 m.; on grassy waste land; 26 May 1942, *Ludlow & Sherriff 8616* (holotype in Herb. Brit. Mus.).

The same gathering included specimens (*Ludlow & Sherriff 8616a*) of *T. eriopodum* Hand.-Mazz., allied to *T. sherriffii*, but the latter has narrow and long-lobed leaves, and darker-coloured involucral bracts with broader white or green margin; moreover the flowers of *T. eriopodum* are more lightly coloured on the outside.

In leaf form *T. sherriffii* is comparable with *T. sinense* Dahlst. and also with *T. sikkimense* Hand.-Mazz., the latter having red achenes and lacking horns on the involucral bracts.

T. sherriffii seems to be closely allied to *T. pseudostenoceras* Van Soest, but the latter is more glabrous, has fewer and more recurved lateral lobes of the leaves, purple petioles and midribs, bigger flower-heads and smooth yellow stigmas.

Taraxacum staticifolium Van Soest, sp. nov.

Planta tenuis c. 12 cm. alta, collo obscure squamato glabro; radix gracilis. *Folia*

glabra, lineari-oblanceolata, plicata, subacuta, ad 6 cm. longa et 0·5 cm. lata, integra vel sparsissime denticulata, petiolo pallido. *Scapi* singuli, tenues, pallidi, sub involucro araneosi. *Involucrum* parvum 10 mm. longum, obscure atro-viride; squamae exteriores laxe appressae, apice recurvae, lanceolatae, 4–6 mm. longae, ad 1·2 mm. latae, immarginatae, ciliolatae, apice laeves; squamae interiores late lineares, membranaceo-marginatae. *Calathium* plus minusve radians c. 2·5 cm. diam.; ligulae luteae, marginales planae extus stria cano-violacea notatae; antherae polline carentes; styli et stigmata fuscescentia. *Floret* aestate. *Achenium* adhuc ignotum.

S.E. TIBET: Gyantse, 4,200 m.; in marshy ground; 7 June 1925, *Ludlow 124* (holotype in Herb. Brit. Mus.).

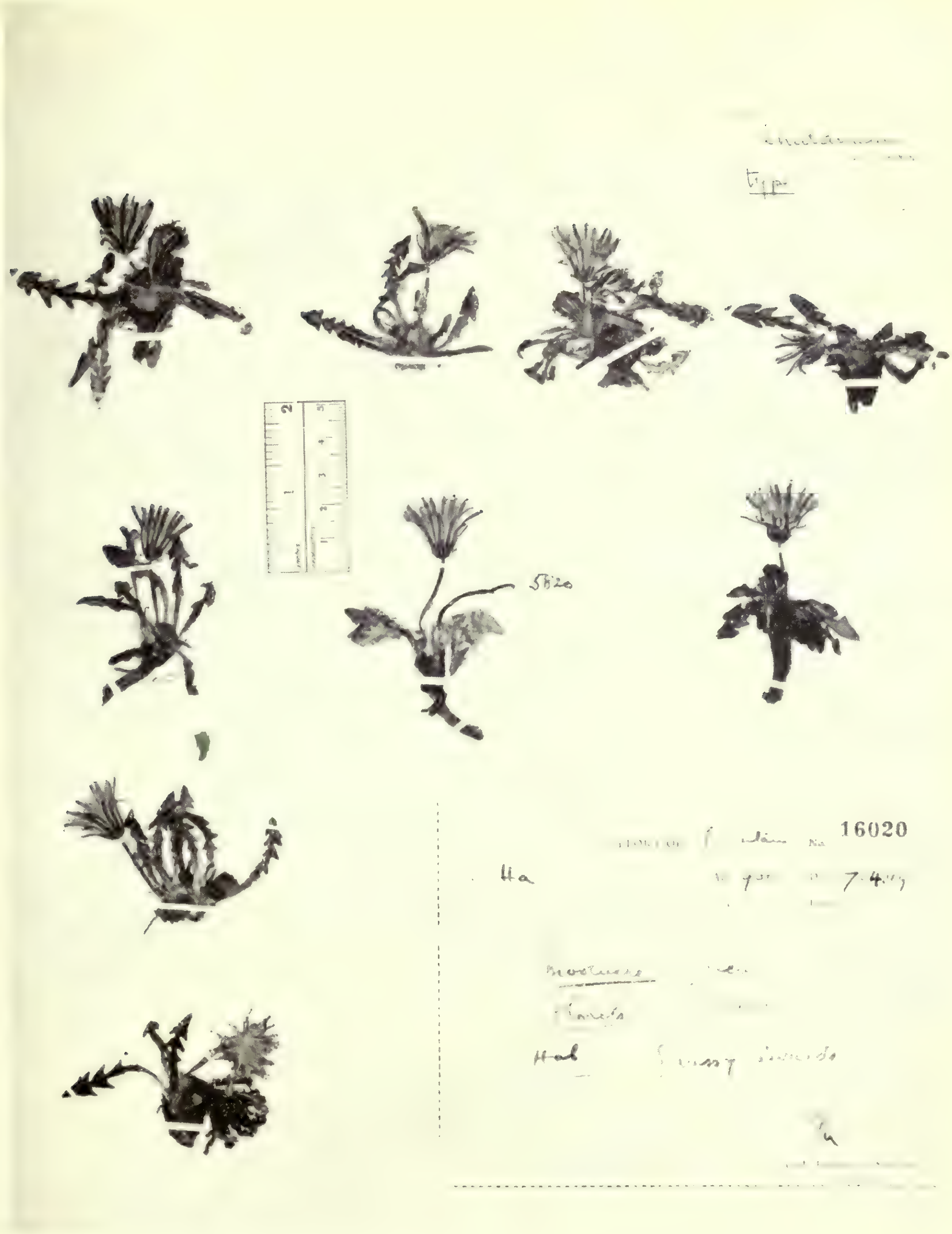
The material is poor, only one specimen being available. The linear-oblanceolate leaves resemble those of *T. leucanthum* (Ledeb.) Ledeb., but the latter species has white flowers and broadly margined outer involucral bracts. On his label the collector of the new species has noted "Flowers pale yellow", but "pale" seems more applicable to the other plant on the same sheet, which is indeterminable.

T. staticifolium may be related to *T. sinense* Dahlst., from which, however, it differs in several ways. The leaves of *T. sinense* have linear or deltoid lateral lobes which can reach a length of 10 mm., and the petiole is purple-violet, not pale as in *T. staticifolium*. Moreover, the involucre in the latter species is much darker, and the anthers lack pollen.

BRITISH MUSEUM
10 FEB 1961
NATURAL HISTORY

PLATE 22

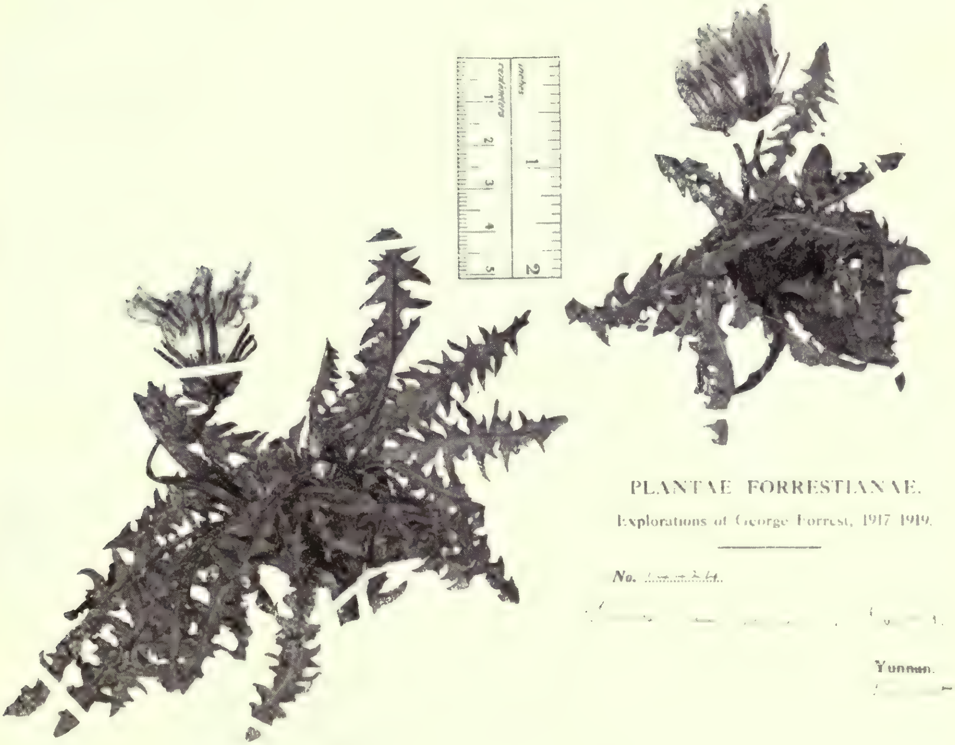
Taraxacum bhutanicum Van Soest.


type
5820
16020

Holotype of *Taraxacum bhutanicum* Van Soest

PLATE 23

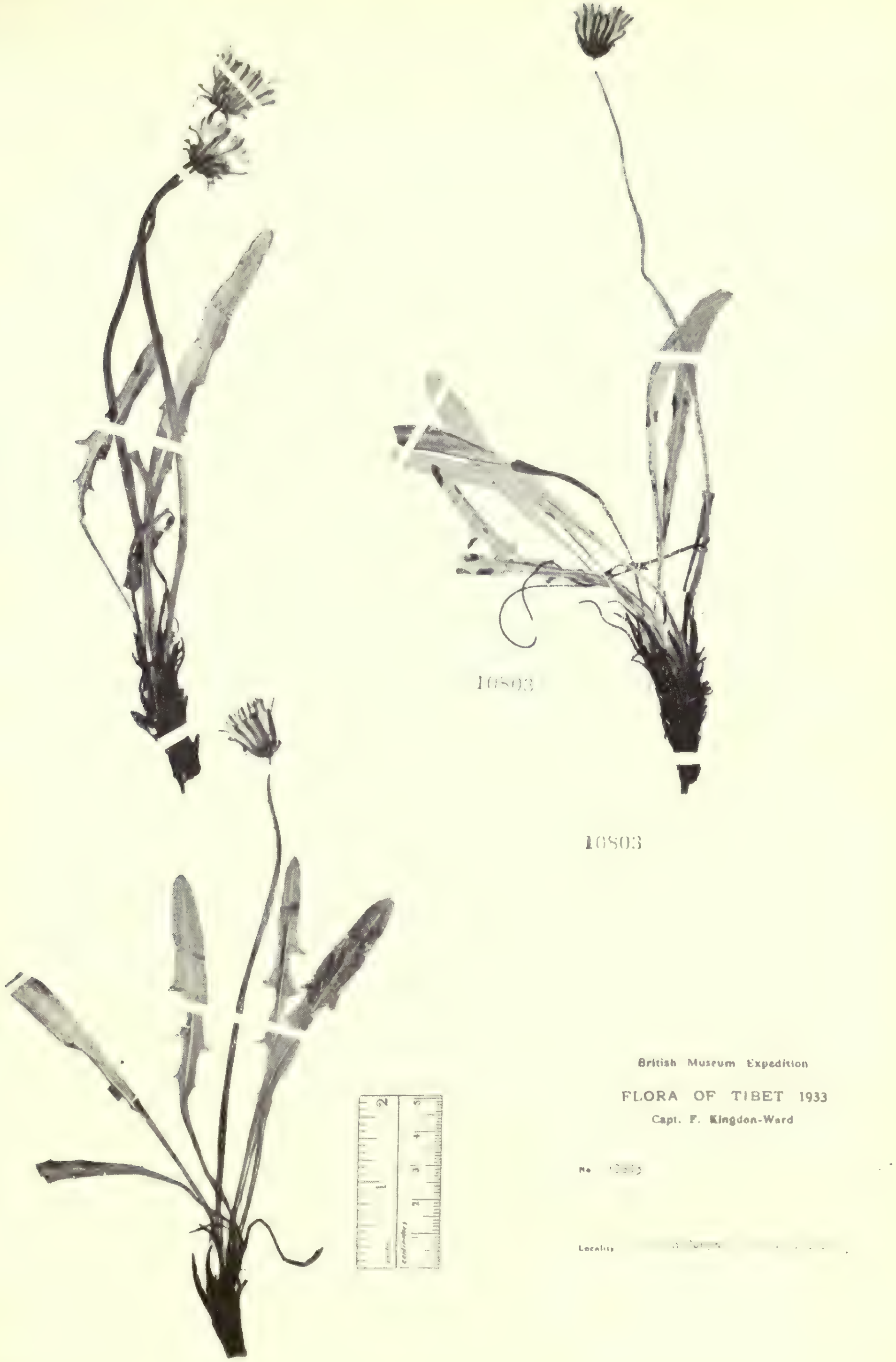
Taraxacum forrestii Van Soest


inches
centimeters
1
2
3
4
5
1
2
PLANTAE FORRESTIANAE.
Explorations of George Forrest, 1917-1919.
No.
Yunnan.

Holotype of *Taraxacum forrestii* Van Soest

PLATE 24

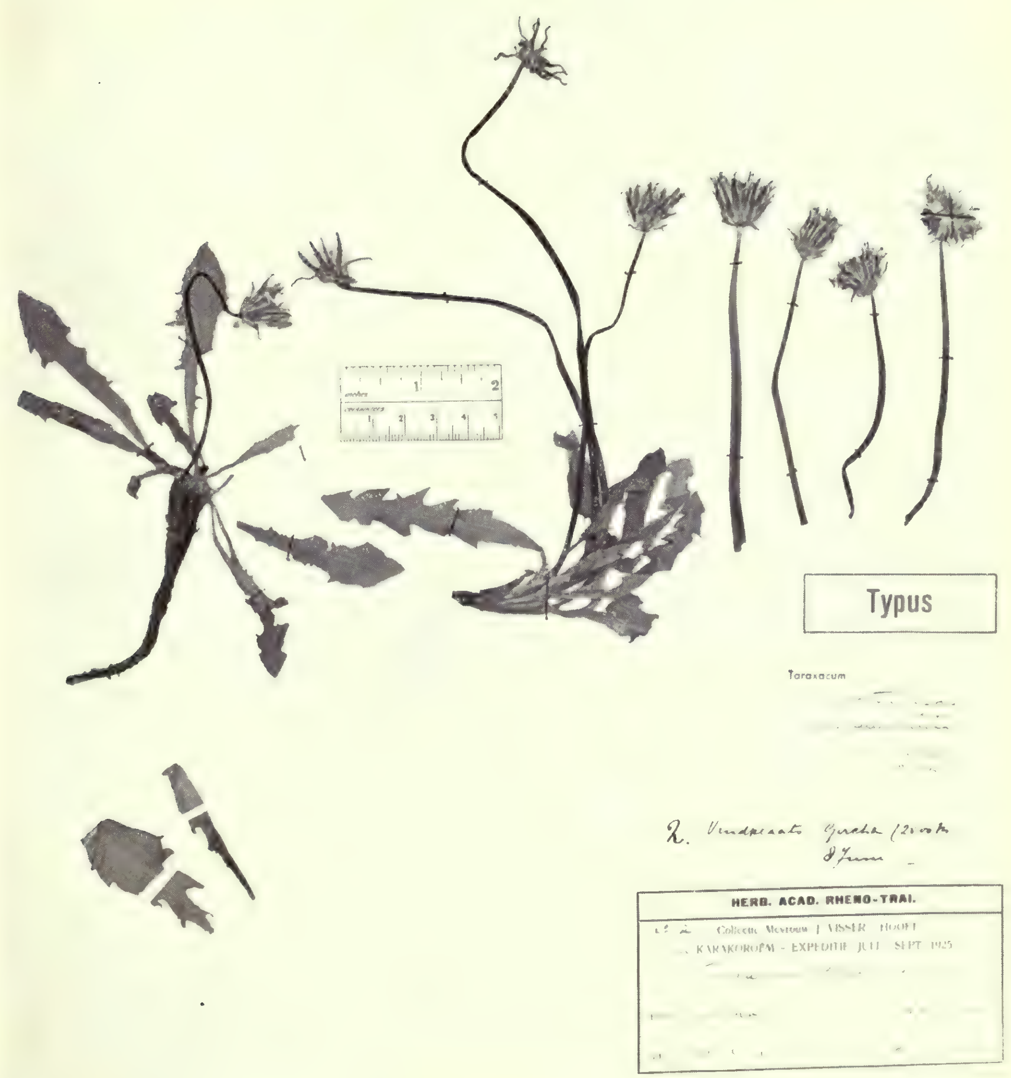
Taraxacum glaucophyllum Van Soest


10803
10803
British Museum Expedition
FLORA OF TIBET 1933
Capt. F. Kingdon-Ward
No.
Locality

Holotype of *Taraxacum glaucophyllum* Van Soest

PLATE 25

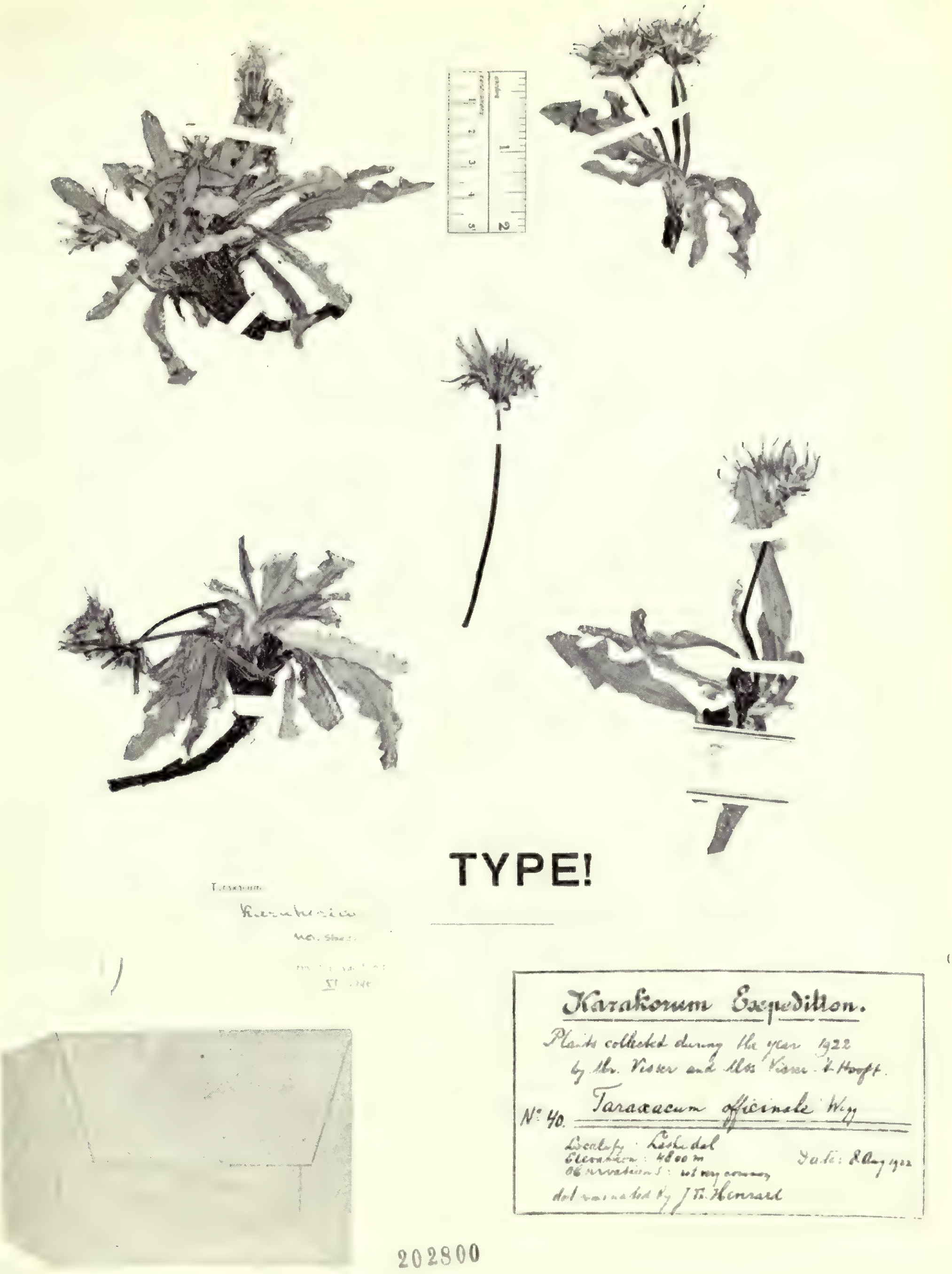
Taraxacum hooftii Van Soest


inches
1
2
centimetres
1
2
3
4
5
Typus
Taraxacum
2. Vindplaats Gircha (2800 m
8 Juni
HERB. ACAD. RHENO-TRAI.
Collectie Mevrouw J. VISSER - HOOFT
KARAKORUM - EXPEDITIE JULI - SEPT 1925

Holotype of *Taraxacum hooftii* Van Soest

PLATE 26

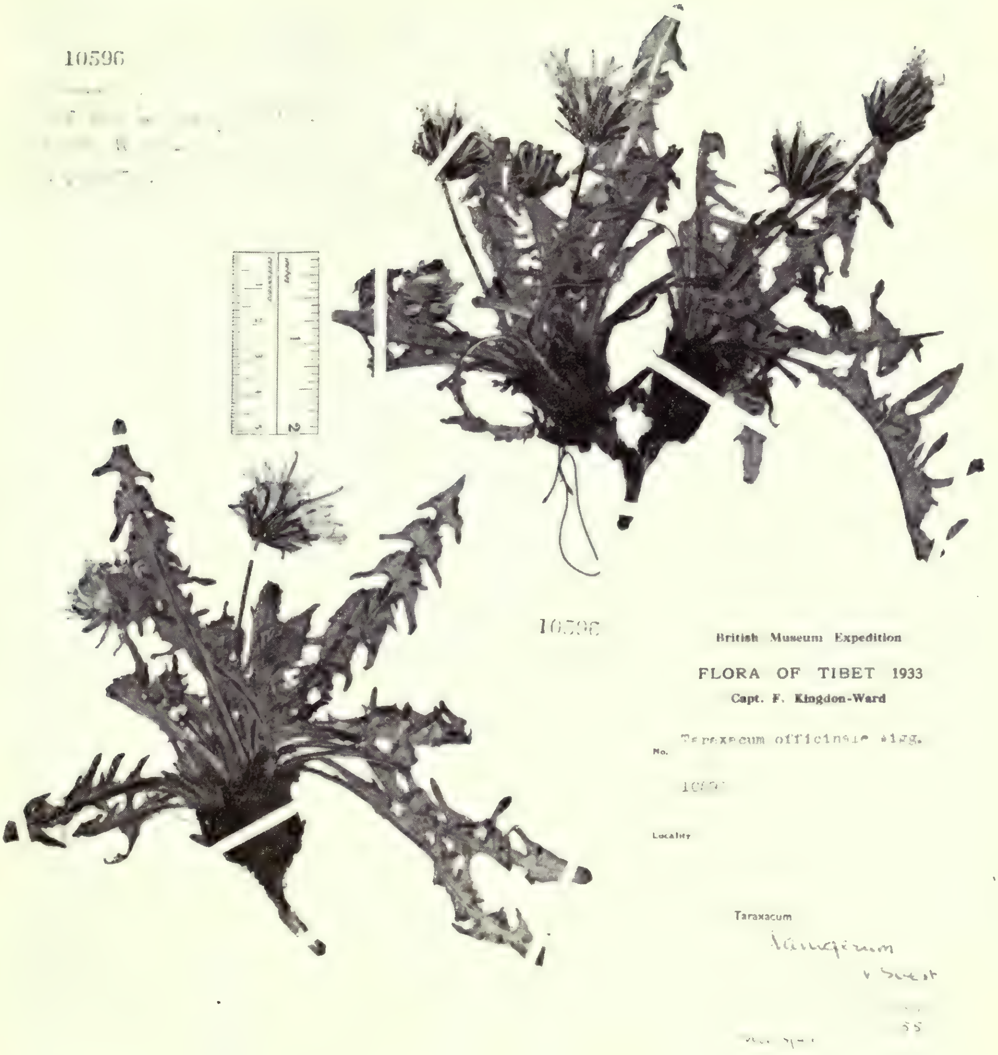
Taraxacum karakoricum Van Soest


TYPE!
Karakorum Expedition.
Plants collected during the year 1922
by Mr. Visser and Mrs Visser-'t Hooft.
N° 40. Taraxacum officinale Wigg
Locality: Lashe dal
Elevation: 4800 m
Observations: not very common
Date: 8 Aug 1922
determinated by J. Th. Henrard
202800

Holotype of *Taraxacum karakoricum* Van Soest

PLATE 27

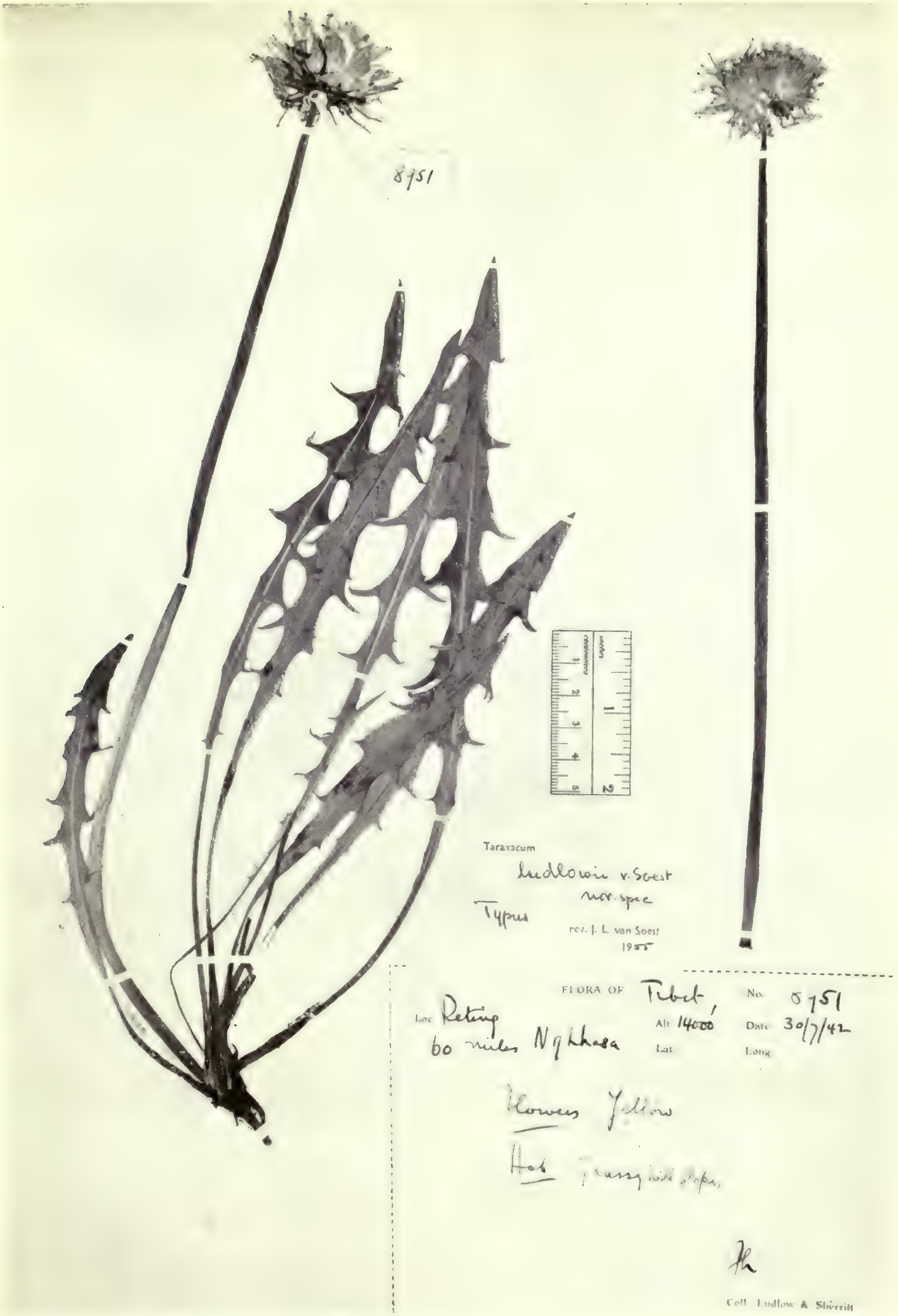
Taraxacum lanigerum Van Soest


10596
10596
British Museum Expedition
FLORA OF TIBET 1933
Capt. F. Kingdon-Ward
No. Taraxacum officinale Wigg.
Locality
Taraxacum
lanigerum
v Soest
55

Holotype of *Taraxacum lanigerum* Van Soest

PLATE 28

Taraxacum ludlowii Van Soest



8751

Taraxacum
ludlowii v. Soest
nov. spec
Typus
rev. J. L. van Soest
1955

FLORA OF Tibet, No. 8751
Loc Reting Alt 14000′ Date 30/7/42
60 miles N of Lhasa Lat Long

Flowers Yellow

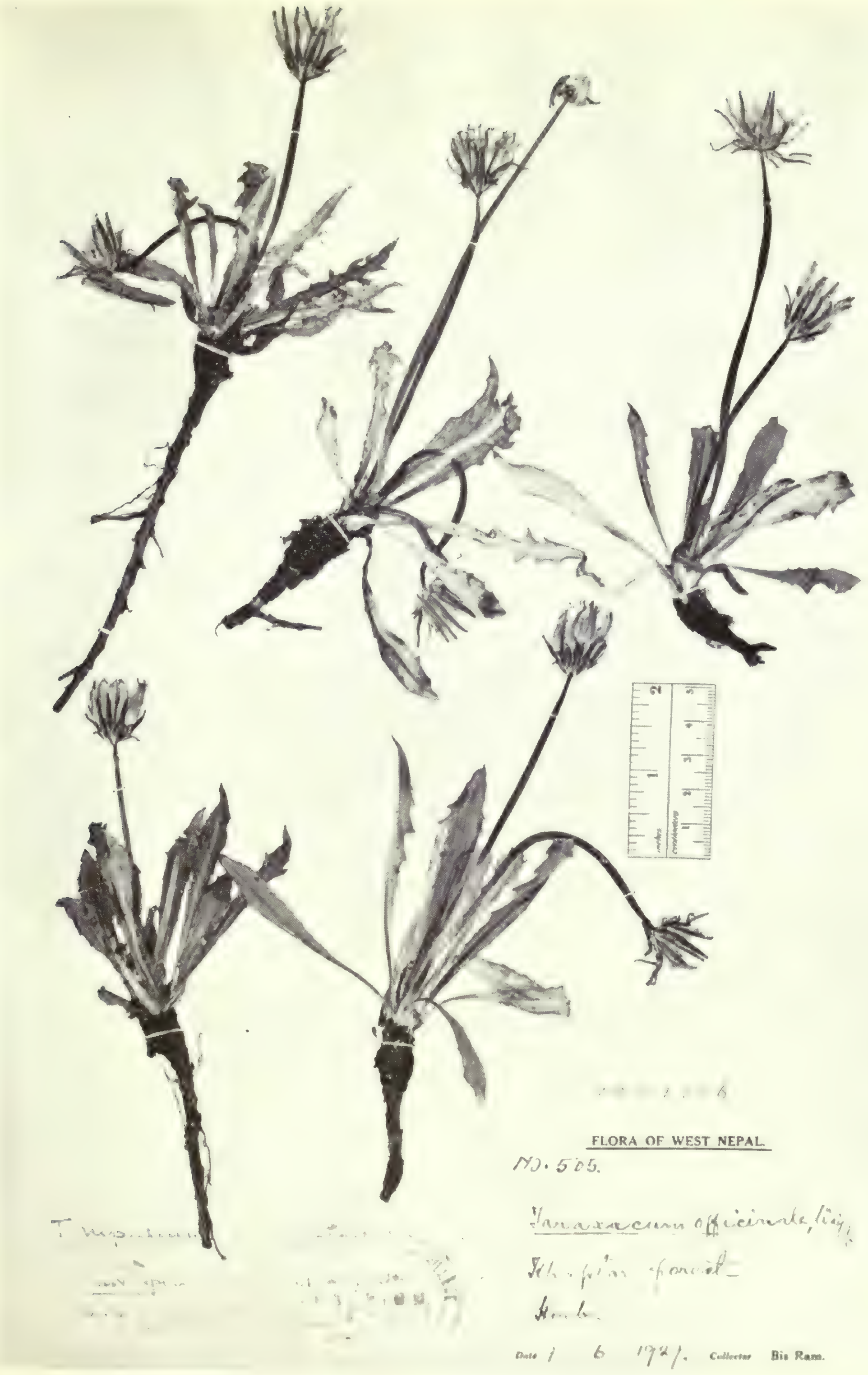
Hab Grassy hill slopes

Coll. Ludlow & Sherriff

Holotype of *Taraxacum ludlowii* Van Soest

PLATE 29

Taraxacum nepalense Van Soest


FLORA OF WEST NEPAL.
No. 505.
Taraxacum officinale, Linn.
Date 1 6 1927. Collector Bis Ram.

Holotype of *Taraxacum nepalense* Van Soest

THE ATHYRIOID FERNS OF CEYLON

28 SEP 62

W. A. SLEDGE

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2. No. 11
LONDON : 1962

THE ATHYRIOID FERNS OF CEYLON

BY

W. A. SLEDGE

(University of Leeds)

BRITISH MUSEUM
28 SEP 1962
NATURAL HISTORY

Pp. 275–323 ; *Plates* 30–32

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 11
LONDON : 1962

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 11 of the Botany series.

© Trustees of the British Museum, 1962

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued September 1962 *Price Sixteen shillings*

THE ATHYRIOID FERNS OF CEYLON

By W. A. SLEDGE

THE need for a revision of the athyrioid ferns of Ceylon early became evident to me when working out my collections made there in 1950–51. No critical study of these plants, or indeed of Ceylon ferns in general, has been undertaken since Beddome's time, and existing lists of species are almost wholly based on his opinions as expressed in the *Handbook to the Ferns of British India, Ceylon and the Malay Peninsula* (1883). Minor changes in nomenclature and arrangement since then have been due to the publication of general taxonomic works on ferns such as Christensen's *Index Filicum* and *Supplements* (1906–34) and Copeland's *Genera Filicum* (1947), and owe nothing to the study of the plants themselves.

In our account of " The Cytology and Taxonomy of the Pteridophyte Flora of Ceylon " Manton and I (in Phil. Trans. R. Soc., Ser. B, ccxxxviii : 127–185 (1954)) maintained the genera *Athyrium* and *Diplazium*—previously united by both Copeland and Holttum—on the grounds that all plants examined both from Ceylon and Malaya consistently differed in their chromosome base-numbers, that of *Athyrium* being 40 as against 41 in *Diplazium*. Since the publication of our paper Mehra and Verma (in Ann. of Bot., New Ser. xxi : 455–459 (1957)) have published cytological data for several North Indian species of *Athyrium* which confirm the haploid number as 40 or 80 in each case, and as no exceptions to the cytological distinction between these two genera have yet come to light the grounds for their retention as such remain.

A satisfactory classification of the athyrioid ferns is more likely to result from the recognition of additional genera at present merged in *Athyrium* or *Diplazium* than by grouping all species into a single genus. Both Ching (in Lingnan Sci. Journ. xxi : 32 (1945)) and Tardieu-Blot (in Mém. Inst. Sci. Madagasc., Sér. B, vii : 30 (1956)) have recently upheld Nakai's genus *Cornopteris*, and another small group of species, with a single representative in Ceylon, has been generically separated and described independently by Ching (in Bull. Fan Mem. Inst. Biol. xi : 81 (1941)) as *Dryoathyrium*, and by Holttum (in Kew Bull. xiii : 447 (1959)) as *Parathyrium*. The genus *Diplaziopsis* has received general recognition, and another group of species probably deserving full generic status is *Pseudallantodia*, originally separated by Clarke (in Trans. Linn. Soc. Lond., Ser. 2, Bot. i : 495 (1880)) as a subgenus of *Asplenium*, characterized by open venation and allantodioid sori covered by thin, fragile, whitish indusia which wrap completely round the sporangia. Beddome long ago expressed the view (Ferns S. Ind. : 52 (1864)) that Clarke's *Asplenium* (*Pseudallantodia*) *procerum* " has hardly a right to a place in Asplenium, Athyrium, or Diplazium, and would be better placed next to Allantodia in a genus distinguished by free venation ". Species showing this distinctive type of sorus and indusium occur in Africa, Asia and South America and would doubtless long ago have been separated generically but for the fact that their distinctive soral characters are only displayed in fronds carrying immature sori. In herbarium specimens of fully mature fronds the characteristic form and structure of the indusial covering can only be detected, if at all, with difficulty. In the following arrangement I have reinstated *Pseudallantodia* as a subgenus of *Diplazium*, though a more comprehensive study of the whole group is likely to lead eventually to its being given independent generic rank.

Though the morphological characters used to distinguish between *Athyrium* and *Diplazium* are admittedly not always sharp, the Ceylon representatives are distinct enough and are readily referable to one or the other genus. As regards the species, these are well marked in *Athyrium*, though Hooker and Baker introduced both taxonomic and nomenclatural errors which were copied and added to by Beddome, whose treatment (op. cit.) of the Ceylon and South Indian species of *Athyrium* was confused and inaccurate. These misinterpretations I have discussed fully elsewhere (in Ann. & Mag. Nat. Hist., Ser. 12, ix : 453–464 (1956)).

The species of *Diplazium* are less easy to distinguish. One of the reasons for this difficulty is that obvious differences due to degree of division of the fronds or pinnae may have little taxonomic value. Such differences, plainly apparent in herbarium specimens, have been given an importance beyond their value by workers unacquainted with the living plants and unaware of the changes which may occur due to age and the influence of habitat. This is notably the case in *D. dilatatum* in which the fronds are simply pinnate when young and may be fully fertile in this condition, but are doubly pinnate when mature ; maturity moreover apparently depends upon other factors than age alone. Such precociously fertile plants of *D. dilatatum* are easily confused with *D. sylvaticum*. Although Beddome was aware of this (*vide* Handb. Ferns Brit. Ind. : 188 (1883)), later authors have sometimes failed to make allowance for such changes due to age and environment. Other species behave in the same way. The fronds of *D. beddomei*, though normally simply pinnate with deeply pinnatifid pinnae and easily distinguished from the bipinnate ones of *D. decurrens*, may sometimes be fully bipinnate and simulate very closely those of the latter species. Even Wall, an acute observer with an excellent field knowledge of Ceylon ferns, was misled by such bipinnate fronds into expressing the belief that the two species intergraded and were not truly distinct from one another. The Malayan *D. cordifolium* provides another instance. In this species the fronds may be either simple or pinnate according to age or environment and may be fully fertile in both conditions. Both forms have been described as species, and other bad species have been founded through ignorance of this biological peculiarity, which is doubtless shared by many *Diplazium* species. Christensen had evidently come to this conclusion when he expressed the view (in Contrib. U.S. Nation. Herb. xxvi : 301 (1931)) that several of Christ's numerous new species of *Diplazium* " can not be regarded as valid ", and concluded that the degree of division of the fronds is an unreliable character " since these large plants vary greatly in cutting, as may be observed in cultivated plants, in which young fronds often are simply pinnate, older ones bipinnate or even tripinnate".

Christensen (op. cit.) considered that more stable characters are to be found in the shape of the ultimate segments, the length of the sori, and in details of venation. To these may be added rhizome, scale and spore characters. Most of the Ceylon species of *Diplazium* are erect-growing ferns with tufted fronds, but a few species have extensively creeping rhizomes. Incomplete specimens lacking rhizomes have been responsible for the failure to distinguish in the herbarium between species with closely similar fronds but widely different growth habits. *D. lasiopteris* and *D. polyrhizon* are examples of two species with widely creeping and strictly erect rhizomes respectively but with fronds which are sufficiently similar to make identification of specimens lacking the basal parts difficult for anyone unacquainted with the living plants. In the same way the strongly creeping rhizomes of *D. muricatum* and *D. procumbens* immediately serve to separate these species from all the other large species of *Diplazium* in Ceylon, which have erect rhizomes. Yet neither of these two species has previously been recorded from Ceylon, both being confused with other species by Hooker and Baker, who, so far as the Kew and British Museum collections show, never saw complete specimens. Beddome's Ceylon specimens of these species also consisted of a single pinna in each case and were in consequence wrongly referred to other species.

Holttum (in Gard. Bull. Str. Settl. xi : 74–108 (1940)) has stressed the value of scale form in distinguishing between Malayan species of similar habit, and scale differences are sometimes useful in separating Ceylon species, as for example *Diplazium decurrens*, which has entire or subentire scales, and *D. dilatatum*, in which the scales are conspicuously toothed.

The spores of both *Athyrium* and *Diplazium* display marked differences in size and surface markings. They are ellipsoid, reniform or plano-convex in shape, either with or without a perispore. Where present the winged perispore may form a few loose undulate folds over the surface, or many anastomosing folds or ridges may be produced to give rise to a reticulate pattern, or again the surface may be covered with spinular or papillar outgrowths. Hieronymus first showed the systematic value of spore characters in this group when he separated the Ceylonese *D. cognatum* which has spinulose spores from the closely similar *D. assimile* of Norfolk Island and Australia in which the spores are smooth. Tardieu-Blot (Aspl. Tonkin (1932)) has also drawn attention to the taxonomic importance of spore characters in these genera and has illustrated the spores of many species.

As regards Ceylon species, the spores often afford characters of the greatest value in identification. The difficulty in distinguishing *Diplazium sylvaticum* from precociously fertile, once pinnate examples of *D. dilatatum* has been referred to above, and the marked difference in spore size affords one of the most useful means of distinguishing the two. *D. decurrens* also affords a particularly good example of the diagnostic value of spore characters in specific identification. It has been treated by different authors as a distinct species or as a variety of either *D. polypodioides* or *D. dilatatum*, though it resembles bipinnate forms of *D. beddomei* much more closely and may sometimes be difficult to distinguish from that species by macroscopic characters. Its reticulate spores, however, are so different from those of all the other species that identification need never be in doubt if mature sori are present.

Beddome (Handb. Ferns Brit. Ind. (1883)) recognized sixteen species from Ceylon under the genera *Lastrea, Athyrium, Diplazium, Anisogonium, Allantodia and Nephrodium.* His arrangement, with little more than nomenclatural changes, was reproduced by Willis (in Ann. R. Bot. Gard. Peradeniya v : 97–98 (1911)). In the following account I distinguish twenty-four species. Three of the additional species belong to *Athyrium*, namely *A. anisopterum*, *A. nigripes* and *A. praetermissum.* The first of these was treated as a simply pinnate form of *A. macrocarpon* by Beddome ; the second he failed to distinguish from *A. solenopteris*, though Thwaites had earlier (Enum. Pl. Zeyl. : 384 (1864)) distinguished it and applied the name correctly ; the third he included with the North Indian fern later distinguished by Hope as *A. mackinnonii* under the erroneously applied name *A. nigripes.* Of the additional species of *Diplazium*, two, *D. decurrens* and *D. cognatum*, were treated by Beddome as varieties of *D. polypodioides* and *D. umbrosum* respectively. *D. polyrhizon* he included, as a synonym, under *D. japonicum.* *D. muricatum* is Beddome's *Athyrium gymnogrammoides* and is also, in part, his *D. umbrosum* var. *australe.* *D. travancoricum* and *D. procumbens* are additions to the fern flora of Ceylon.

Most of the athyrioid ferns in Ceylon are plants of medium to high elevations growing on the ground in shady forest, in moist places near streams, or by the side of forest clearings. *Athyrium hohenackeranum, Diplazium subsinuatum, D. zeylanicum* and *D. esculentum* occur at low elevations—up to 750 m.—but of these *D. esculentum*, which grows in wet ground in full exposure, is the only common species. Several species, including all the other species of *Athyrium* together with *Diplazium muricatum* and *D. procumbens*, are high-altitude plants rarely descending below 1,500 m. The remainder are mainly found in the zone between 600–1,500 m.

The most widely distributed of the Ceylon species are *Athyrium anisopterum, Diplazium sylvaticum, D. dilatatum, D. esculentum, D. polypodioides* and *D. muricatum.* These mostly extend—though not necessarily continuously—from North India and South China eastwards to the Philippines and southwards to Java or beyond. *A. nigripes* and *A. praetermissum* are found in North and South India and in Java though not apparently in Malaya. *A. macrocarpon* has a similar distribution save that it is also recorded from north Indo-China. *Diplaziopsis javanica* is also common to India, Ceylon and Java and extends eastwards to New Caledonia and Polynesia but is absent from Malaya.

Of the more restricted species, *Diplazium procumbens* is known only from Malaya (Pahang) and the mountains of Ceylon. *Athyrium hohenackeranum, A. solenopteris, Diplazium lasiopteris* and *D. travancoricum* are confined to Ceylon and southern India with the exception of the first named, which extends northwards to Bombay.

So far as our present knowledge goes, the following species are confined to Ceylon : *Diplazium zeylanicum, D. polyrhizon, D. beddomei, D. decurrens, D. cognatum* and *D. paradoxum.*

In the following key to the genera, the characters for *Dryoathyrium* and species of *Diplazium* with anastomosing veins refer to Ceylon species.

Veins free :
Sori circular ; indusia small and fugacious . . . . . *Dryoathyrium*
Sori elongate ; indusia conspicuous :
At least some and usually most sori hooked or reniform with indusia connected across the veins . . . . *Athyrium*
Sori not hooked or reniform, often double (back to back) and then without connecting indusia . . . . *Diplazium*
Veins anastomosing :
Fronds bipinnate . . . . *Diplazium*
Fronds simply pinnate :
Sori circular . . . . *Anisocampium*
Sori elongate . . . . *Diplaziopsis*

My grateful thanks are due to the Directors and Curators of the following herbaria for access to, or for the loan of, specimens in their charge. Abbreviations used in the citation of specimens are those adopted in the *Index Herbariorum*.

BM = British Museum (Natural History).
CGE = Botany School, Cambridge University.
E = Royal Botanic Garden, Edinburgh.
K = Royal Botanic Gardens, Kew.
PDA = Botanic Gardens, Peradeniya.
SING = Botanic Gardens, Singapore.
US = United States National Museum, Smithsonian Institution, Washington, DC.

ANISOCAMPIUM C. Presl

Rhizome creeping, clothed with narrow, entire, thin, pale brown scales. Lamina imparipinnate, pinnae few, lobed, glabrous ; veins pinnate in the lobes, the lower ones anastomosing at an acute angle, with an excurrent veinlet where they meet. Sori medial on the veinlets. Indusium small and deciduous, reniform or athyrioid. Type : *A. cumingianum* C. Presl.

1. **Anisocampium cumingianum** C. Presl in Abhandl. K. Böhm. Ges. Wiss., Folge 5, vi : 419 (1851).

Goniopteris aristata Fée, Mém. Fam. Foug. v : 253 (1852), *nom. illegit.*
Cyclodium cumingianum (C. Presl) T. Moore, Index Fil. : lxxxiii (1857), 275 (1861).
Aspidium otaria Kunze ex Mett. in Abhandl. Senckenb. Naturforsch. Ges. ii : 318 (1858).
Nephrodium aristatum Hook., Sp. Fil. iv : 62, t. 238 (1862), *nom. illegit.*
Pleocnemia aristata Bedd., Ferns S. Ind. : 28, t. 83 (1863), *nom illegit.*
Nephrodium otaria (Kunze ex Mett.) Bak. in Hook. & Bak., Synops. Fil. : 288 (1867).—Bedd., Handb. Ferns Brit. Ind. : 267 (1883).
Dryopteris otaria (Kunze ex Mett.) Kuntze, Revis. Gen. Pl. ii : 813 (1891).—C. Chr., Index Fil. : 281 (1905).
Athyrium otaria (Kunze ex Mett.) Posth. in Proc. Fourth Pacific Sci. Congr. iii : 197 (1930).
Athyrium cumingianum (C. Presl) Ching in C. Chr., Index Fil., Suppl. 3 : 40 (1934).

Stipes 20–40 cm. long, pale-coloured, naked or with a very few, scattered, linear, pale brown scales. Lamina 20–30 cm., broadly ovate or oblong-ovate, pinnate with

3–6 pairs of distant pinnae and a terminal pinna like the lateral ones, the lowest pinnae not reduced; lateral pinnae 8–15 × 2–3 cm., broadly linear-oblong, apex acuminate, dentate-serrate, margins coarsely and often irregularly lobed $\frac{1}{4}$–$\frac{1}{3}$ the way to the midrib, the lobes serrate; lowest pair of veins in each lobe anastomosing with an excurrent vein which runs out to the margin and often joins one or two of the superior veins; rhachis and both surfaces of pinnae glabrous; texture thinly herbaceous. Sori medial, small, circular. Indusium delicate, fugacious, margins laciniate. Spores plano-convex or ellipsoid, 36–39 × 27–30 μ, with a wide median perispore wing and reticulately anastomosing surface folds.

Forests at low elevations and in the drier parts of the central region. Rare.

CEYLON: Minipe, 150 m.; shady forest by Mahaweli River; 9 Jan. 1954, *Sledge 945* (BM). Near Weragamtota, 120 m.; shady forest; 10 Jan. 1954, *Sledge 953* (BM). *Gardner* in *Thwaites C.P. 1299* (BM; K; PDA). *Hooker & Thomson 28* (BM). *Wall* in *Herb. Hance 20619* (BM).

South India, Siam, Yunnan, Philippines.

DRYOATHYRIUM Ching

Rhizome bearing long-persistent fleshy stipe bases. Stipes with two vascular bundles (joining above to form one U-shaped strand), scaly below with narrow, entire, broad-based scales. Fronds bipinnatifid or tripinnatifid, pinnae or pinnules deeply pinnatifid, connected by a narrow wing on each side of the pinna rhachis; rhachis slightly grooved above, the groove not open at the junction of pinnae or pinnules; rhachides, costae and veins bearing lax multicellular hairs above and beneath; veins free, simple or forked. Sori round, elongate or athyrioid, indusiate. Spores with a perispore. Type: *Aspidium boryanum* Willd. (= *D. boryanum* (Willd.) Ching).

2. **Dryoathyrium boryanum** (Willd.) Ching in Bull. Fan Mem. Inst. Biol. xi: 81 (1941). (Plate 30 fig. 1.)

Aspidium boryanum Willd. in L., Sp. Pl., ed. 4, v: 285 (1810).
Aspidium divisum Wall., Numer. List: 13, n. 393 (1829), *nom. nud.*
Lastrea boryana (Willd.) T. Moore, Index Fil.: 86 (1858).—Bedd., Handb. Ferns Brit. Ind.: 266 (1883).
Nephrodium boryanum (Willd.) Hook., Sp. Fil. iv: 126 (1862), excl. specim. Carmichael.
Nephrodium divisum Hook., tom. cit.: 133 (1862).
Lastrea divisa (Hook.) Bedd., Ferns S. Ind.: 35, t. 97 (1863).
Aspidium divisum (Hook.) Wall. ex Thw., Enum. Pl. Zeyl.: 392 (1864).
Polypodium subtripinnatum C. B. Clarke in Trans. Linn. Soc. Lond., Ser. 2, Bot. i: 545 (1880).
Dryopteris divisa (Hook.) Kuntze, Revis. Gen. Pl. ii: 811 (1891).
Phegopteris kingii Bedd., Suppl. Ferns Brit. Ind.: 84 (1892) ("*Kingi*").
Dryopteris boryana (Willd.) C. Chr., Index Fil.: 255 (1905).
Athyrium boryanum (Willd.) Tagawa in Act. Phytotax. & Geobot. iv: 144 (1935).—Ching in Lingnan Sci. Journ. xv: 396 (1936).
Ctenitis boryana (Willd.) Copel., Gen. Fil.: 123 (1947).
Cornopteris boryana (Willd.) Tard. in Amer. Fern Journ. xlviii: 32 (1958).
Parathyrium boryanum (Willd.) Holtt. in Kew Bull. xiii: 449 (1959).

Rhizome stout, ascending, the apex clothed with narrow, entire, brown scales. Stipes 50–100 cm. long, sparsely scaly. Lamina broadly ovate, acute, 50–100 cm. or more long, 30–80 cm. wide, deeply tripinnatifid ; rhachis channelled above, with scattered filiform scales ; pinnae numerous, alternate, stalked, ascending, the largest up to 40 × 15 cm., the lowermost somewhat reduced ; texture thin, herbaceous ; pinna rhachis channelled with septate hairs above, *the groove not continuous with those of the pinnules or of the main rhachis* ; *pinnules* well spaced, in small fronds 3·5 × 1 cm., in large fronds up to 10 × 2·5 cm., sessile or nearly so and *connected* (save in the proximal parts of large pinnae) *by a very narrow wing on either side of the rhachis*. deeply pinnatifid with broadly oblong, obtuse, toothed segments ; lateral veins in the segments simple or forked. *Sori round*, in a single row on each side of the segments and nearer the costa than the margin. Indusium reniform, small, thin and fugacious. Spores plano-convex, 46 × 30 μ, covered with thick, blunt papillae.

Forests of the interior from 900 to 1,800 m.

CEYLON : Corbet's Gap, 1,110 m. ; by stream in shady forest ; 22 Jan. 1954, *Sledge 1030* (BM). Hakgala, 1,650 m. ; by stream in forest ; 26 Feb. 1954, *Sledge 1213* (BM). *Thwaites C.P. 3097* (BM ; E ; K ; PDA) (Thwaites, Enum. Pl. Zeyl. : 392 (1864), cites Raxawa and Haputelle as localities for this number). *Hutchison* (K). *Robinson* (K). *Ferguson* (US 816399).

East Africa, Réunion, South India, North India from Simla eastwards to Assam, Burma, Yunnan, Malay Peninsula, Java, Sumatra, Borneo, Philippines.

The systematic position of this fern is difficult to assess, as is shown by the numerous genera to which it has been assigned. Morphologically it shows a mixture of dryopteroid and athyrioid characters. Most recent authors have placed it in or near to *Athyrium*, and cytologically its affinity with that genus is upheld by its possession of the same basic chromosome number of 40.

At lower elevations in Ceylon it is a large fern with fronds 2 m. tall, resembling *Microlepia speluncae* in general habit and appearance.

ATHYRIUM Roth

Rhizome usually short, erect or decumbent, or sometimes (but never in Ceylon species) creeping. Scales ovate, entire, light brown, thin-walled. Rhachis sparsely scaly or glabrescent, papillate in the grooved upper surface ; costae of pinnae and pinnules grooved above, the edges of the groove often strongly winged and the wing interrupted and enlarged at the junction of the costa of a pinnule with the pinna rhachis or sometimes excurrent to form a more or less prominent spinule ; lamina pinnate to tripinnate, texture thin, venation anadromous, veins always free. Sori variously shaped, at least the lowest acroscopic sorus of any group and often most sori elongated along the veins with lateral indusium, and hooked, i.e. consisting of two unequal arms placed back to back, the larger arm opening inwards and joined by the indusium across the vein at the outer end to the shorter arm which opens outwards ; or sometimes horseshoe-shaped or reniform (dryopteroid) or straight (asplenioid). Indusium of the same outline, margins entire or lacerate-fimbriate. Type : *Polypodium filix-femina* L. (= *A. filix-femina* (L.) Roth).

Key to the Species of *Athyrium*

Fronds markedly narrowed below . . . . . 3. *hohenackeranum*
Fronds not markedly narrowed below :
  Pinnules spinulose above :
    Pinnae up to 5 cm. long, strongly spinulose above ; indusium entire 4. *nigripes*
    Pinnae 5–15 cm. long, with or without spinules above ; indusium jagged 5. *solenopteris*
  Pinnules not spinulose above :
    Pinnule lobes sharply serrate . . . . . . 5. *solenopteris*
    Pinnule lobes, if present, not sharply serrate :
      Scales light-coloured ; sori mostly reniform :
        Lamina bipinnate, 8–25 cm. broad . . . . 6. *macrocarpon*
        Lamina pinnate to sub-bipinnate, 4–6 cm. broad . . 7. *anisopterum*
      Scales dark-coloured ; sori mostly straight . . 8. *praetermissum*

3. **Athyrium hohenackeranum** (Kunze) T. Moore, Index Fil. : xlix (1857).—Bedd., Ferns S. Ind. : 50, t. 150 (1864). (Plate 30 fig. 2.)

Allantodia hohenackerana Kunze, Farrnkr. ii : 63, t. 126 (1850) (" *Hohenackeriana* ").
Asplenium hohenackeranum (Kunze) Mett. in Abhandl. Senckenb. Naturf. Ges. iii : 237 (1859).

Rhizome short, decumbent, apex densely ferruginous-paleaceous, fronds tufted. *Stipes* short, 1–6 cm. long, *clothed with spreading linear-subulate*, pale brown, entire *scales. Lamina pinnate or sub-bipinnate,* 10–30 cm. long, sometimes longer, 2–5 cm. wide, elliptic, *narrowed at both ends,* glabrous above and below, texture herbaceous, flaccid ; pinnae in numerous pairs, up to 2·5 cm. long, lanceolate or ovate-lanceolate, cut nearly or quite to the rhachis into ovate or oblong pinnules which are sharply serrate above, *lower ones reduced.* Sori copious, upper ones straight, lower ones hooked or reniform. Indusium brown, margins entire. *Spores* ellipsoid or plano-convex, 36–39 × 27–30 μ, *with a narrow winged perispore* and a few surface folds.
On moist, open clay banks at low elevations. Not common.

Ceylon : Matale East, 1865–66, *Thwaites C.P. 3867* (CGE ; K ; PDA). Matale East, 630 m. ; moist open bank between Pallegama and Etanwela ; 4 Mar. 1954, *Sledge 1236* (BM). Lagalla, Central Province, 600 m., *T. W. Naylor Beckett 769* (BM ; K). Managalla, 600 m., 4 Feb. 1891, *Hancock* (K). Weragamtota, Central Province, 450 m., 10 Jan. 1954, *Sledge 952* (BM). *Hancock 4* (US 1277181).

India.

Apparently confined in Ceylon to the transitional belt between the wet and dry zones on the eastern and northern sides of the hills of the Central Province. It is the only species of *Athyrium* in Ceylon found at low elevations.

4. **Athyrium nigripes** (Bl.) T. Moore, Index Fil. : xlix (1857), 98 (1858).—Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 454, t. 14 (1956). (Plate 30 fig. 3.)

Aspidium nigripes Bl., Enum. Pl. Jav. ii : 162 (1828).

Asplenium nigripes (Bl.) Hook., Sp. Fil. iii : 222 (1860).—Thw., Enum. Pl. Zeyl. : 384 (1864).—Hope in Journ. Bombay Nat. Hist. Soc. xiv : 119 (1902).

Athyrium tenuifrons var. *tenellum* T. Moore, Index Fil. : 188 (1860) pro parte, quoad syn. *Aspidium nigripes, Asplenium nigripes, Athyrium nigripes.*

Athyrium tenuifrons var. *stramineum* T. Moore, loc. cit. (1860).

Asplenium filix-femina sensu Hook. & Bak., Synops. Fil. : 227 (1867) pro parte, quoad syn. *A. stramineum* ; non Bernh.—Ferguson, Ceyl. Ferns : 31 (1880).

Athyrium solenopteris sensu Bedd., Handb. Ferns Brit. Ind. : 166 (1883) pro parte ; non T. Moore.

Rhizome erect, fronds tufted. Stipes up to 20 cm. long, black at the base, scaly below, upper part and rhachis glabrous. *Scales ovate* or lanceolate, acute, entire, pale brown. Lamina bipinnate, 10–20 (30) cm. long, 4–7 cm. wide, lanceolate, acuminate ; *pinnae* patent or slightly ascending, usually about 3 × 1 cm., sometimes more, lanceolate or oblong-lanceolate, apex *obtuse or subacute, not acuminate* ; pinnules elliptic or oblong, sessile or lowermost with short stalks, margins entire or with a few teeth especially about the rounded apex, posterior margin decurrent on the rhachis, anterior margin cuneate or rounded, basal acroscopic pinnules often larger and sub-pinnatifid, *upper surface with prominent spinules on the rhachis and costae,* otherwise glabrous above and below, texture herbaceous. Sori short, 1–2 mm., spreading from the costae in two rows, mostly straight, the lowermost often hooked. *Indusium* brown, *margins entire or slightly dentate. Spores* plano-convex to reniform, 42–48 × 24–27 μ, *without a perispore.*

Forests of the Central Province from 1,500 to 2,100 m.

CEYLON : Horton Plains, on path to Haldummula, Sept. 1890 (PDA). Horton Plains, 2,100 m.; in shady forest by stream ; 30 Dec. 1950, *Holttum 39221* (SING). Ramboda Pass, 1,920 m. ; by track from summit of pass to Maturata ; 17 Mar. 1954, *Sledge 1314* (BM). Jungles on the Maturata side of Nuwara Eliya, *Freeman 185* A, *186* B (BM). Kandapola Forest Reserve, Nuwara Eliya, 1,950 m., 19 Mar. 1954, *Sledge 1321* (BM). *Thwaites C.P. 3067* (CGE ; K ; PDA—data for specimens in PDA : Ramboda, Nuwara Eliya, Feb. 1857 ; Kandapola patana, 1867). *Gardner* (K). *Bradford* (BM). *Hutchison* (E). *Wall* (E).

Assam, Sikkim, South India (Nilgiris), Java.

Ceylon examples of *Athyrium nigripes* agree in all respects with Blume's Javan specimens. In the *Synopsis Filicum* Hooker and Baker misapplied the epithet *nigripes* to *A. praetermissum* and other species and were copied by Clarke and Beddome (see Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 454–455 (1956)).

The spinules or setae on the upper surface of the pinna rhachis and pinnules are always well developed in *Athyrium nigripes.* They are commonly 1 mm. long and may reach a length of 2 mm. Similar outgrowths are also present in *A. solenopteris* and *A. praetermissum* but they are rarely so well developed and are often confined to the pinna rhachis in the former and always so in the latter species.

Other differences between *A. nigripes* and *A. solenopteris* are referred to under that species.

5. **Athyrium solenopteris** (Kunze) T. Moore, Index Fil. : 43 (1857), 187 (1860).—Bedd., Handb. Ferns Brit. Ind. : 166 (1883) excl. parte.—Alderw. van Rosenb., Malayan Ferns : 433 (1909).—Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 456 (1956). (Plate 30 fig. 4.)

Allantodia solenopteris Kunze in Linnaea xxiv : 266 (1851).

Asplenium ceylanense Klotzsch in Cat. Hort. Van Houtte (1858).

Asplenium solenopteris (Kunze) Mett. in Abhandl. Senckenb. Naturforsch. Ges. iii : 240 (1859).—Hook., Sp. Fil. iii : 221 (1860).

Asplenium aspidioides sensu Hook., tom. cit. : 223 (1860) pro parte, quoad specim. ex Nilgiri et Ceylon ; non Schlecht.—Thw., Enum. Pl. Zeyl. : 385 (1864).

Athyrium ceylanense (Klotzsch) T. Moore, Index Fil. : 181 (1860).

Athyrium scandicinum sensu T. Moore, op. cit. : 187 (1860) pro parte, quoad specim. ex India et Ceylon ; non C. Presl.

Athyrium pectinatum Bedd., Ferns S. Ind. : 51, t. 155 (1864) pro parte ; non *Asplenium pectinatum* Wall. ex Mett.

Asplenium nigripes sensu Hook. & Bak., Synops. Fil. : 227 (1867) pro parte ; non Hook.

Rhizome erect or decumbent, fronds tufted. Stipes 20–40 cm. long or more, sometimes shorter, scaly at the base ; scales lanceolate, acuminate, entire, pale brown ; upper part of stipe and rhachis glabrous. Lamina bipinnate or sub-tripinnate, variable in size, (15) 25–50 (60) × (6) 10–20 (25) cm., lanceolate to ovate-oblong, acute or acuminate ; *pinnae* normally patent or ascending, sometimes deflexed (var. *pusillum*), up to 15 × 3 cm., narrowly oblong, *acute or acuminate*, lower one or two pairs slightly reduced ; *pinnules* shortly stalked, ovate or oblong, obtuse, mostly *pinnatifid about half-way or more to the costa, lowest ones on middle and lower pinnae often fully pinnate*, posterior base cuneate, anterior truncate, *segments sharply toothed*, both surfaces glabrous, *upper surface of pinna rhachis and costa usually spinulose* but spinules sometimes weakly developed and confined to distal ends of pinna rhachis or even quite absent ; texture herbaceous. Sori mostly in two rows one on each side of the costa, in the larger pinnules forming rows also on the lobes, upper ones straight, lower hooked or reniform. *Indusium* thin, light brown, *margins laciniate. Spores* plano-convex to reniform, 42–48 × 24–30 μ, *without a perispore.*

5*a*. **Athyrium solenopteris** var. **solenopteris.**

Lamina broadly lanceolate to ovate-oblong, normally 25–50 × 10–20 cm. ; pinnae patent or ascending, middle and lower ones 3–6 cm. apart, largest up to 15 × 3 cm. with spaced pinnules.

Mountain forests above 1,500 m.

CEYLON : Nuwara Eliya, 10 May 1906, *C. G. Matthew* (K). Same locality, *Freeman 183* A, *184* B (one frond var. *solenopteris*, one frond var. *pusillum*) (BM). Same locality, July 1887 (E). Kandapola Forest Reserve, near Nuwara Eliya, 1,920 m., 19 Mar. 1954, *Sledge 1322, 1324, 1325* (BM). *Thwaites C.P. 1346* (BM ; E ; K ; PDA—data for specimens in PDA : Nuwara Eliya, Jan. 1847, *Gardner*). Hakgala, 1,740 m. ; by track in jungle ; 27 Dec. 1950, *Sledge 746* (BM). Ramboda Pass, 1,920 m.; in forest by track from summit of pass to Maturata; 17 Mar. 1954, *Sledge 1317* (BM). *Walker* (K). *Wall* (E; K). *Beddome* (BM). *Bradford* in *Herb. Hance* (BM). *Hooker & Thomson 208* (BM). 1,800 m.; boggy places; *Hutchison* (E).

South India.

5*b*. **Athyrium solenopteris** var. **pusillum** (Kunze) T. Moore, Index Fil.: 187 (1860).—Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix: 457, t. 15 (1956).

Allantodia solenopteris var. *pusilla* Kunze in Linnaea xxiv: 267 (1851).
Asplenium gymnogrammoides Klotzsch ex Mett. in Abhandl. Senckenb. Naturforsch. Ges. iii: 237 (1859).
Athyrium gymnogrammoides (Klotzsch ex Mett.) Bedd., Ferns S. Ind.: 52 (1864) excl. descr. et fig.

Fronds smaller, 20–40 cm. long including stipe; lamina narrower, 6–10 cm. wide; *pinnae* patent or *commonly deflexed,* 3–6 cm. long, more crowded, lower ones 1·5–3 cm. apart; pinnules more or less approximate, inciso-serrate or shallowly pinnatifid or lower ones pinnatipartite.

With var. *solenopteris* in mountain forests.

CEYLON: Nuwara Eliya, Moon Plains, 1,800 m.; damp ground in jungle; 23 Dec. 1950, *Sledge 714* (BM). Pedrotallagalla, 1,950 m., 26 Dec. 1950, *Sledge 735* (BM). Kandapola Forest Reserve, Nuwara Eliya, 1,920 m., 19 Mar. 1954, *Sledge 1326* (BM). Namunukula, 1,875 m., 24 Feb. 1954, *Sledge 1202* (BM).

South India (Nilgiris).

Athyrium solenopteris is frequent about Nuwara Eliya growing in shady forest. It varies much in size. The variety *pusillum* is distinguished by its smaller size, the narrower outline of its fronds and the shorter, more crowded and normally deflexed pinnae; but it is connected by intermediates with the larger more typical variety. It was to such a small plant gathered by Gardner in Ceylon that Klotzsch first applied the manuscript name *Asplenium gymnogrammoides* which Mettenius later validated by description under that epithet. Hooker misapplied Mettenius's name to *Athyrium praetermissum* and Beddome, when transferring it to *Athyrium,* based his description and figure on a pinna of *Diplazium muricatum* sent to him by Thwaites as *Asplenium gymnogrammoides.* The description of *Athyrium gymnogrammoides* in Beddome's later *Handbook* (1883) was also based on this specimen. (See Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix: 459 (1956)).

Athyrium solenopteris differs from *A. nigripes* in its larger size, broader, bipinnate-tripinnatifid fronds with sharply serrate pinnules and laciniate indusia. Small forms of both varieties of *A. solenopteris,* comparable in size with *A. nigripes,* may be distinguished by their tapering or acuminate pinnae, which are commonly deflexed, their sharply serrate pinnules and their laciniate indusia. In *A. nigripes* the narrowly lanceolate fronds have patent or ascending pinnae which are blunt or subacute but never acuminate; the elliptic, obtuse pinnules are subentire or sparsely and bluntly toothed and always strongly spinulose above, and the straighter sori have entire indusia.

6. **Athyrium macrocarpon** (Bl.)Bedd., Ferns S. Ind.: 51, t. 153 (1864) excl. t. 152; Handb. Ferns Brit. Ind.: 165 (1883). (Plate 30 fig. 5.)

Aspidium macrocarpon Blume, Enum. Pl. Jav. ii : 162 (1828).
Asplenium macrocarpon (Bl.) Hook., Sp. Fil. iii : 222 (1860).

Rhizome erect, fronds tufted. Stipes 10–40 cm. long, clothed at the base with *narrow, elongate, brown scales*; *upper part of stipe and rhachis usually with scattered filiform scales,* rarely quite glabrous. Lamina bipinnate, 20–50 × 8–25 cm., oblong-lanceolate or ovate, gradually narrowed to the acute apex, lowest pinnae often slightly shorter than the next; pinnae patent or ascending, stalked, 5–15 × 2–4 cm., lanceolate, acuminate, texture firm; *pinnules* shortly stalked, becoming sessile then adnate distally, mostly 1–2 × 0·5–1 cm., the basal acroscopic ones often enlarged and up to 3 cm. long, oblong or ovate-oblong, obtuse or subacute, posterior base cuneate, anterior truncate or rounded, *sinuate-lobate or shallowly pinnatifid,* the basal acroscopic pinnules more deeply divided, *lobes obtuse or acute*; rhachis of pinnae and veins of pinnules usually with scattered filiform hair-like scales beneath, especially at the base, rarely quite glabrous, upper surfaces glabrous and *devoid of spinules.* Sori in two rows between the costa and margins of the pinnules and in the larger anterior basal lobes, *mostly reniform,* often becoming confluent and more or less covering the lower sides of the pinnae when ripe. *Indusium lead-coloured when fresh, margins laciniate.* Spores plano-convex, 45–54 × 30–36 μ, with a perispore forming a medium undulate wing and irregular folds or ridges on the surface.

Mountain forests of the Central Province from 1,500 to 2,100 m.

CEYLON: Nuwara Eliya; woods; 1844, *Gardner 1112* (BM; CGE; K). Same locality, *Freeman 174* B, *175* C (BM). Same locality, *Mrs. Chevalier* (BM). Adam's Peak, 1,950 m., 14 Dec. 1950, *Sledge 616* (BM). Pedrotallagalla, 2,025 m., 26 Dec. 1950, *Sledge 728* (BM). Horton Plains, 2,100 m., Dec. 1950, *Sledge P.257* (BM). Ramboda Pass, 1,920 m.; by track from summit of pass to Maturata; 17 Mar. 1954, *Sledge 1311, 1312* (BM). Kikilimane, near Nuwara Eliya, 2,040 m., 20 Mar. 1954, *Sledge 1342* (BM). *Thwaites C.P. 1372* (BM; E; K; PDA; US—data for specimens in PDA: Nuwara Eliya, Jan. 1847, *Gardner*; Ramboda, Jan. 1854, *Gardner*). *Gardner 1064* (K). *Gardner 1103* (CGE). *Mrs. Walker* (K). *Robinson 71* (K). *Wall* (E; K). *Hooker & Thomson 207* in part (BM). *Hutchison* (E).

North and South India, Tonkin, Java.

Blume's type sheet at Leyden carries three fronds, one with a scaly stipe about 30 cm. long, another with a lamina 40 cm. long and 12 cm. broad. The pinnules are subentire or crenate-dentate rather than pinnatifid. In Ceylon the pinnules are usually more deeply divided but in other respects they match the Javan specimens. Beddome's illustration of what he took to be typical *Athyrium macrocarpon* (Ferns S. Ind.: t. 152 (1864)) represents *A. anisopterum.* His illustration of *A. macrocarpon* var. β (op. cit.: t. 153) represents Blume's species.

Athyrium macrocarpon is frequent in forests about Nuwara Eliya. The fronds are thicker in texture and less dissected than those of *A. solenopteris.* In habit it is more like *A. praetermissum* but that has very different sori. Characters which mark it off from all other Ceylon species of the genus are the numerous strongly curved sori, more lastreoid than athyrioid in shape, and the grey or lead-coloured indusia of the living plant. The ripe spores are also quite different from those of all other Ceylon species save *A. anisopterum.* Tardieu-Blot's description (Aspl. Tonkin : 84 (1932)) of the spores as pale yellow with a very regular perispore wing applies only to imperfect stages. When fully mature the spores are dark-coloured and the surface folds of the perispore contract to form continuous thickened ridges or crests over the face of the spores.

7. **Athyrium anisopterum** Christ in Bull. Herb. Boiss. vi : 962 (1898).—Hu & Ching, Ic. Fil. Sin. i : 41, t. 21 (1930). (Plate 30 fig. 6.)

Athyrium macrocarpon Bedd., Ferns S. Ind. : 51, t. 152 (1864) pro parte ; non *Aspidium macrocarpon* Bl.—Holtt., Fl. Malaya ii : 550, fig. 323 (1954).

Asplenium macrocarpon var. *atkinsonii* Hook. & Bak., Synops. Fil., ed. 2 : 489 (1874) ("*Atkinsoni*").—C. B. Clarke in Trans. Linn. Soc. Lond., Ser. 2, Bot. i : 489 (1880).

Athyrium macrocarpon var. *atkinsonii* (Hook. & Bak.) Tard., Aspl. Tonkin : 84, t. 12 figs. 3, 4 (1932).

Rhizome oblique or erect. Stipes tufted, up to 25 cm. long but generally much shorter, clothed below with narrow elongate brown scales ; upper part of stipe and rhachis glabrous or with scattered filiform scales. *Lamina pinnate or bipinnate at the base,* 15–20 × 4–6 cm., *narrowly oblong or oblong-lanceolate* ; *pinnae* shortly stalked, patent or lower ones often deflexed, 2–3 × 1 cm., *rhomboid-ovate,* base very unequal, cuneate on the posterior side, truncate or rounded with the basal lobe enlarged forming an *auricle on the anterior side,* margins beyond the auricle lobed or pinnatifid, or the lowest pinnae often fully pinnate, lobes blunt, entire or with a few teeth, apex of pinna obtuse or subacute, lower surface usually with a few short hairs on the veins, upper surface glabrous ; texture herbaceous. Sori medial on the veins, mostly reniform, the distal ones hooked or straight. Indusium grey, margins laciniate. Spores plano-convex, 48–51 × 32–35 μ, with a perispore forming a median undulate wing and irregular folds or ridges on the surface.

Mountain forests of the Central Province from 1,500 to 2,100 m.

CEYLON : Hantane and Ramboda, Jan. 1854, *Thwaites C.P. 1372* (PDA). Mt. Pedrotallagalla, 1,920 m., 19 Dec. 1950, *Ballard 1187* (K). Wattekelly Hill, 1,500 m., Sept. 1864, *T. W. Naylor Beckett* (E). Between Pattipola and Horton Plains, 1,950 m. ; in jungle ; 20 Dec. 1950, *Sledge 671* (BM). *Gardner 1112* (K). *Mrs. Walker 1880* (K). *Thwaites* (BM). *Gardner* in *Herb. J. Smith* (BM) (four fronds on one sheet with one of *A. macrocarpon*).

Yunnan, Kwangtung, Tibet, N.W. Himalaya eastwards to Assam, South India, Burma, Indo-China, Malaya, Luzon, Borneo.

Beddome's illustration of *Athyrium macrocarpon* (Ferns S. Ind. : t. 152 (1864)) represents *A. anisopterum* ; his illustration of *A. macrocarpon* var. β (op. cit. : t. 153), however, represents true *A. macrocarpon.* The Malayan plant described and figured by Holttum (Fl. Malaya ii : 550, fig. 323 (1954)) as *A. macrocarpon* is also *A. anisopterum.* Ceylon specimens agree well with examples from Yunnan whence this species was described. It has been variously treated as a distinct species or as a form or variety of *A. macrocarpon*. Christensen, after treating it as distinct, reduced it (in Contrib. U.S. Nation. Herb. xxvi : 297–298 (1931)) to a form of *A. macrocarpon*, but the Ceylon plant has been shown (Manton & Sledge in Phil. Trans. R. Soc., Ser. B, ccxxxviii : 138, 164 (1954)) to be distinct cytologically. I have not met with intermediates in Ceylon and Clarke claimed that he had seen no intermediates between var. *atkinsonii* and *A. macrocarpon* though Beddome (Handb. Ferns Brit. Ind. : 165 (1883)) states that they are " connected by intermediate forms " in the Nilgiris.

Athyrium anisopterum differs from *A. macrocarpon* in its much smaller, narrowly oblong, simply pinnate fronds with auriculate pinnae. It grows in similar situations to *A. macrocarpon* but is less frequent.

8. **Athyrium praetermissum** Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 457, t. 16 (1956). (Plate 30 fig. 7.)

Asplenium gymnogrammoides sensu Hook., Sp. Fil. iii : 227 (1860) pro parte, quoad specim. ex Ceylon et India ; non Klotzsch ex Mett.—Thw., Enum. Pl. Zeyl. : 385 (1864) pro parte.

Athyrium costale T. Moore, Index Fil. : 180 (1860) pro parte, quoad specim. ex Ceylon et Nilgiri ; non *Aspidium costale* Bl.

Athyrium nigripes sensu Bedd., Ferns S. Ind. : 52, t. 157 (1864) ; Handb. Ferns Brit. Ind. : 166 (1883) pro parte ; non T. Moore.

Asplenium nigripes sensu Hook. & Bak., Synops. Fil. : 227 (1867) pro parte ; non Hook.—C. B. Clarke in Trans. Linn. Soc. Lond., Ser. 2, Bot. i : 490 (1880) pro parte.—Ferguson, Ceyl. Ferns : 29 (1880).

Athyrium solenopteris sensu Bedd., Handb. Ferns Brit. Ind. : 166 (1883) pro parte, quoad syn. *Athyrium nigripes* Bedd. ; non T. Moore.

Rhizome erect, scaly, fronds tufted, up to 75 cm. long. Stipes 15–40 cm., firm, erect, often purple, base clothed with many *narrow, elongate, dark chestnut to black scales*, 10 × 1 mm., lower part of stipe with scattered scales, upper part and rhachis smooth but rhachis often with short papillar hairs. Lamina bipinnate, deltoid in the smaller fronds, becoming oblong-ovate in larger fronds, narrowed to the acute apex, 10–40 × 10–25 cm., texture firm ; pinnae stalked, patent or ascending, usually about 10 cm. long but varying from 5 to 20 cm., 2–5 cm. wide, elongate-acuminate, apex often somewhat caudate ; pinnules stalked, 1–3·5 × 0·5–1 cm., oblong or ovate-oblong, normally obtuse but sometimes acute in large fronds, superior base rounded or truncate, usually more or less auricled, inferior base cuneate, sometimes almost entire (var. *erythrorachis*), more often serrate or lobed or even pinnate (var. *tripinnatum*) with toothed lobes ; rhachis with papillar hairs in the dorsal groove and often on the pinnule veins beneath, otherwise glabrous, *dorsal groove interrupted at the base of the pinnules and forming a prominent spine or tooth*, similar spines being developed along the main rhachis in the distal part of the frond. *Sori* mostly in two rows close to the costae, *mostly straight*, basal ones sometimes hooked, 2 mm. long. *Indusium golden or russet-coloured*, firm, *entire* or slightly repand. *Spores* plano-convex to reniform, 45–50 × 25–30 μ, *without a perispore*.

8*a*. **Athyrium praetermissum** var. **praetermissum.**

Fronds oblong-ovate, pinnules shallowly to deeply lobed, with serrate margins. Mountain forests of the Central Province above 1,500 m.

CEYLON : Nuwara Eliya, Apr. 1899, *Gamble 27564* (K). Nuwara Eliya, Mt. Pedrotallagalla, 2,100 m., 26 Dec. 1950, *Ballard 1258* (K). Hakgala peak, 1,800 m., 16 Dec. 1950, *Ballard 1102* (K). Same locality, 1,675 m., 30 Dec. 1950, *Ballard 1339* (K). Adam's Peak, 14 Feb. 1908, *C. G. Matthew* (K). Knuckles Mt., 1,650 m., 30 Jan. 1954, *Sledge 1077* (BM, holotype ; K). Ramboda Pass, 1,890 m. ; at summit by track to Maturata; 17 Mar. 1954, *Sledge 1299, 1310* (BM). *Thwaites C.P. 1344* (BM ; E ; K ; PDA—data for specimens in PDA : Ramboda, Sept. 1847, *Gardner* ; Udapussalawa, Apr. 1854, *Gardner*). *Thwaites C.P. 1345* (E ; K). *Gardner 1068* (PDA). *Gardner 1069* (K). *Walker* (K). *Wall* (E). *Hutchison* (E). *Hooker & Thomson 207* in part (BM).

India, Java.

8*b*. **Athyrium praetermissum** var. **erythrorachis** (Bedd.) Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 459, t. 17 (1956).

Athyrium gymnogrammoides var. *erythrorachis* Bedd., Suppl. Ferns S. Ind. Brit. Ind. : 12 (1876) ; Handb. Ferns Brit. Ind. : 168 (1883).

Fronds smaller, stipes purple, lamina deltoid, pinnules entire or nearly so. Mountain forests. Frequent about Nuwara Eliya.

CEYLON : Nuwara Eliya, *Freeman 177* B, *181* F (BM). Nuwara Eliya, Moon Plains, 1,800 m. ; in secondary forest ; 23 Dec. 1950, *Sledge 719* (BM). Horton Plains, *Thwaites C.P. 1344* in *Herb. Brodie* (E). Same locality, 2,040 m. ; in jungle ; 19 Dec. 1950, *Sledge 697* (BM). Badulla, Sept. 1864, *Thwaites C.P. 1344* in *Herb. Brodie* (E). Kandapola Forest Reserve, Nuwara Eliya, 1,800 m., 19 Mar. 1954, *Sledge 1338* (BM). *Gardner 1067* (CGE ; K ; PDA). *Thwaites C.P. 1344* (PDA). 1,950–2,100 m., *Thwaites C.P. 1344* in *Herb. Beddome* (BM). 1870, *Beddome* (K). *Wall* (E).

Endemic.

8*c*. **Athyrium praetermissum** var. **tripinnatum** Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 459, t. 18 (1956).

Fronds large, oblong-ovate, lowest pinnae fully bipinnate. Mountain forests. Not common.

CEYLON : Ramboda Pass, 1,890 m. ; at summit by track to Maturata ; 17 Mar. 1954, *Sledge 1304* (BM, holotype). *Hutchison 187* (E). *Thwaites C.P. 1344* (PDA). *Trimen* in *Thwaites C.P. 1344, 1345* in *Herb. Beddome* (K).

Endemic.

In the *Species Filicum* Hooker misapplied the name *Asplenium gymnogrammoides* to this species and in the *Synopsis Filicum* Hooker and Baker referred it to *Asplenium* *nigripes*. Further confusion was introduced by Beddome, whose concept of *Athyrium gymnogrammoides* was based on a pinna of *Diplazium muricatum* sent to him by Thwaites as *Asplenium gymnogrammoides*. Beddome's *Athyrium nigripes* covers both *A. praetermissum* and the N.W. Indian plant later distinguished by Hope as *A. mackinnonii*. Specimens of *A. praetermissum* in herbaria have therefore usually been referred to either *A. nigripes* or *A. gymnogrammoides*. For further details see my paper in Ann. & Mag. Nat. Hist., Ser. 12, ix : 453–464 (1956).

This species agrees with *Cornopteris* in having fleshy horn-shaped papillae or outgrowths in the groove at the junctions of the rhachis and pinnae (whence that generic name), and also in the presence of spines on the upper side of the pinna rhachis at the bases of the pinnules. Ching (in Lingnan Sci. Journ. xxi : 33 (1945)) makes no mention of the former character but states that all *Cornopteris* species agree in having " very thin leaf-texture, . . . horizontally patent, sessile and opposite pinnae, with the basal pair always the broadest, having the segments or pinnules on the lower side of costa greatly abbreviated towards the base, the linear (sometimes forked in the lower pinnae), exindusiate, cinnamon-brown sori and the broadly winged bilateral spores ". Too many of these characters are foreign to *Athyrium praetermissum* to justify a generic transfer.

Athyrium praetermissum is a common fern about Nuwara Eliya and is easily distinguished from other Ceylon species of *Athyrium* by its narrow, dark scales, predominantly straight sori in two rows near the costae, and golden-brown indusia. It varies in size and depth of cutting of the pinnules. These are often auricled at the superior base but sometimes, as in the type specimen, the auricles are lacking and I unfortunately overlooked the omission of " saepe " from the original description. The variety *erythrorachis* with small, deltoid fronds and entire pinnules is also frequent about Nuwara Eliya ; the variety *tripinnatum* is less common. Specimens of var. *praetermissum* from the Nilgiri Hills agree exactly with Ceylon plants. There are also specimens from Java and N.E. India, both at Kew and the British Museum, which are apparently the same variety.

Hybrids

Where *Athyrium* species grow intermixed, wild hybrids are formed. *A. praetermissum* appears to be particularly prone to hybridize and plants referable to the following crosses have been found.

Athyrium macrocarpon × *praetermissum* Sledge in Ann. & Mag. Nat. Hist., Ser. 12, ix : 463, t. 20 (1956).

Rhizome erect, fronds tufted, 60 cm. high. Stipes with many narrow elongate dark brown to blackish scales at the base and scattered ones above. Lamina ovate-lanceolate, acute, bipinnate, 30 × 20 cm., lowest pinna somewhat shortened, texture firm ; pinnae mostly alternate, patent, about 10 cm. long, lowermost 4–5 cm. apart, main rhachis and pinna rhachis weakly fibrillose beneath with linear scales ; pinnules stalked, ovate, bluntly crenate-lobate, the basal acroscopic lobe more or less developed into an auricle, veins sparsely hairy beneath ; pinna rhachis and costa without spines or teeth on the upper surface. Sori mostly in two rows close to the costae, straight or curved, a few of the basal acroscopic ones horseshoe-shaped. Indusium broad, brown, margin toothed.

CEYLON : Kikilimane, near Nuwara Eliya, 2,040 m., 20 Mar. 1954, *Sledge 1343* (BM).

In habit like *Athyrium macrocarpon* and with the fibrillose rhachis and under sides of the pinnules of that species, but with the linear, dark, basal scales of *A. praetermissum,* with which the predominantly straight or curved sori lying close to the costae also agree.

Athyrium praetermissum × *solenopteris* Sledge, loc. cit., t. 19 (1956).

Rhizome decumbent, fronds tufted, variable in size from 50–150 cm. high. Stipes with narrow elongate brown scales at the base, glabrous or almost so above. Lamina broadly ovate-oblong, bipinnate or subtripinnate, texture firm ; pinnae alternate, distant, lowermost 5–15 cm. apart, ascending, up to 30 cm. long ; pinnules stalked, well spaced, 1–4 × 0·5–1 cm., ovate or lanceolate, obtuse, subentire or lobed or (in the largest basal pinnae) divided quite to the rhachis into regular, oblong, oblique lobes, rounded or serrate at the apex ; rhachis of pinnae groved above with a tooth or spine at the insertion of the pinnule, costa of pinnule also grooved above and spinulose on the margin of the groove. Sori mostly in two rows close to the costae of the pinnules or pinnule lobes, straight or hooked, some of the basal ones horseshoe-shaped. Indusium firm, slightly dentate, reddish ; sporangia abortive.

CEYLON : Horton Plains, 2,100 m., 18 Dec. 1950, *Sledge 686* (BM). Same locality, Sept. 1890 (PDA). Nuwara Eliya, Jan. 1854, *Thwaites C.P. 1346* (PDA). Kandapola Forest Reserve, Nuwara Eliya, 1,920 m., 18 Mar. 1954, *Sledge 1319* (BM ; K).

Intermediate in appearance, though *Sledge 1319* is more robust than either parent. The *Athyrium praetermissum* characters are seen in the size and shape of the linear scales, the firm texture, the conspicuous spinules at the junction of the pinnule and pinna rhachis, the shape of the sori, which are predominantly straight or curved, and the firm more or less ferrugineous indusium. The *A. solenopteris* characters are shown in the brown scales, the lax, subtripinnate form of the fronds with remote ascending pinnae, and the dentate margins of the indusia.

DIPLAZIUM Sw.

Rhizome usually short, erect, or sometimes creeping. Scales ovate to linear, brown to dark brown in colour, edges entire or toothed, the teeth when present formed of two adjacent cells, the ends of which often diverge. Stipes sometimes muricate below or throughout from prominences formed by the bases of fallen scales. Rhachides sparsely scaly or glabrescent, papillate in the grooved upper surface ; costae of pinnae and pinnules grooved above, the edges of the groove often strongly winged and the wing interrupted and enlarged at the junction of the costa of a pinnule with the pinna rhachis ; lamina simple to quadripinnate, texture usually herbaceous, venation never anadromous ; veins usually free or in a few species adjacent vein groups anastomosing more or less freely. Sori elongated along the veins with lateral indusia, the lowest acroscopic sorus in any group usually double (diplazioid) and occasionally other sori also double, but single (asplenioid) sori usually predominating and sometimes all sori single but then tumid and allantodioid; double sori with two quite separate indusia not grading into a horseshoe-shape with indusium continuous across the vein. Type: *Asplenium plantaginifolium* L. (= *D. plantaginifolium* (L.) Urb.).

KEY TO THE SPECIES OF *DIPLAZIUM*

- Veins free:
  - Fronds entire . . . . 9. *subsinuatum*
  - Fronds not entire:
    - Fronds pinnatifid . . . . 10. *zeylanicum*
    - Fronds pinnate, bipinnate or tripinnate:
      - Fronds pinnate; pinnae entire or deeply pinnatifid:
        - Rhizome creeping . . . . 11. *lasiopteris*
        - Rhizome erect:
          - Scales entire, pale . . . . 12. *polyrhizon*
          - Scales toothed, dark:
            - Pinnae deeply pinnatifid, the lobes united by a narrow wing to the pinna rhachis . . . . . . 13. *beddomei*
            - Pinnae not deeply pinnatifid, or if so without a wing to the pinna rhachis:
              - Pinnae entire or shallowly lobed . . . 15. *sylvaticum*
              - Pinnae pinnatifid . . . . 16. *dilatatum*
      - Fronds bipinnate or tripinnate:
        - Rhizome erect:
          - Scales 5 mm. long, the margins entire or inconspicuously toothed:
            - Pinnules decurrent on the pinna rhachis, not forming a continuous wing (except in small fronds); spores reticulate . 14. *decurrens*
            - Pinnules decurrent on the pinna rhachis, forming a continuous narrow wing; spores not reticulate . . . . 13. *beddomei*
          - Scales 10 mm. long, the margins conspicuously toothed:
            - Stipes smooth:
              - Terminal part of pinnae serrate for less than one-third of their length . . . . 16. *dilatatum*
              - Terminal part of pinnae forming long serrate apices at least one-third of their length . . . . . 17. *travancoricum*
            - Stipes muricate . . . . . 18. *polypodioides*
        - Rhizome creeping:
          - Sori allantodioid:
            - Lobes of pinnules 3–5 mm. wide; pinna rhachis and costa with broad entire scales beneath; sori 1–3 mm. long, in two rows close to the costa . . . . 22. *muricatum*

Lobes of pinnules 5–8 mm. wide ; pinna rhachis and costa with narrow toothed scales or none beneath ; sori 3–6 mm. long, diverging from the costa . . . . 23. *procumbens*

Sori not allantodioid . . . . 19. *cognatum*

Veins anastomosing :

Stipes smooth . . . . 20. *esculentum*

Stipes muricate . . . . 21. *paradoxum*

Subgen. DIPLAZIUM

Veins free or, in a few species, anastomosing. Sori linear or oblong, at least the lowest acroscopic ones diplazioid. Indusia firm, opening from their outer edges.

Sect. DIPLAZIUM

Veins free.

The bulk of the species belong to this section.

9. **Diplazium subsinuatum** (Hook. & Grev.) Tagawa, Col. Ill. Jap. Pterid. : 203 (1959.) (Plate 30 fig. 8.)

Asplenium lanceum Thunb., Fl. Jap. : 333 (1784).—Hook., Sp. Fil. iii : 235 (1860).—Hook. & Bak., Synops. Fil. : 229 (1867).

Scolopendrium dubium D. Don, Prodr. Fl. Nepal. : 9 (1825) ; non *Diplazium dubium* Link (1833).

Asplenium subsinuatum Hook. & Grev., Ic. Fil. i : t. 27 (1827).

Diplazium lanceum (Thunb.) C. Presl, Tent. Pterid. : 113 (1836) ; non *D. lanceum* Bory (1833).—Bedd., Handb. Ferns Brit. Ind. : 174 (1883).

Athyrium dubium (D. Don) Ohwi in Bull. Nat. Sci. Mus. Tokyo iii : 99 (1956).

Rhizome long-creeping, scaly. Stipes distant, slender, 10–15 cm. long, paleaceous with linear, acuminate, entire, black scales. *Lamina lanceolate,* 15–30 cm. long, 2–3 cm. wide, *entire or repand,* attenuate at both ends, glabrous above and below, opaque ; texture subcoriaceous ; costa prominent beneath ; veins pinnate, the superior and sometimes the inferior branch of each group often fertile. Sori linear, distant, remote from the costa, mostly simple, some diplazioid. Spores ellipsoid to plano-convex, 40 × 30 μ, strongly and irregularly papillate, papillae 6–9 μ long, often confluent.

Forests of the Central Province up to 1,000 m.

CEYLON : *Thwaites C.P. 1335* (BM ; E ; K ; PDA—data for specimens in PDA : Murata, Jan. 1848, *Gardner* ; Wattegoda, Feb. 1854 ; Matale East, 600–900 m.). *T. W. Naylor Beckett 36* (BM ; E). *Robinson C 75* (K). *Wall* (E). 1899, *Anderson* (E). *Hutchison* (E).

Japan, China, Formosa, Luzon, Indo-China, Himalaya from eastern Nepal to Assam.

10. **Diplazium zeylanicum** (Hook.) T. Moore, Index Fil. : 340 (1862).—Bedd., Handb. Ferns Brit. Ind. : 175 (1883). (Plate 30 fig. 9.)

Asplenium zeylanicum Hook., Sp. Fil. iii : 237 (1860) ; Second Cent. Ferns : t. 16 (1861).

Diplazium pinnatifidum Fée, Mém. Fam. Foug. x : 29, t. 35 fig. 3 (1865) ; non *D. pinnatifidum* Kunze (1834).

Rhizome long-creeping, scaly. Stipes distant, slender, 10–15 cm. long, paleaceous with linear, acuminate, entire, dark brown scales. *Lamina lanceolate*, 15–25 cm. long, 2–4 cm. wide, *deeply pinnatifid in the middle, pinnate at the base*, becoming lobed and then serrate towards the acuminate apex ; lobes and pinnae horizontal, oblong, obtuse ; texture firm, herbaceous ; costa prominent beneath, lower half scaly like the stipe ; veins pinnate, entire or forked. Sori linear, short, up to six pairs in each lobe or pinna, basal acroscopic ones usually diplazioid, the rest simple. Spores ellipsoid to plano-convex, 40 × 30 μ, strongly and irregularly papillate, papillae 6–9 μ long, often confluent.

Forests of the Central Province. Rare.

CEYLON : Kotmalee Oya, 1,200 m. ; on banks ; Mar. 1846, *Gardner 1249* (K, type ; PDA as *Thwaites C.P. 3101*). *Thwaites C.P. 3101* (BM ; E ; K ; PDA—data for specimens in PDA : as above ; also Ambagamuwa, Nov. 1854, *Gardner*). *Robinson C 76* (K). *Wall* (E ; K). 1876, *Hutchison* (E). 1899, *Anderson* (E). *Ferguson* (US *815523*).

Endemic.

11. **Diplazium lasiopteris** Kunze in Linnaea xvii : 568 (1843) ; *op. cit.* xxiv : 270 (1851).—Bedd., Ferns S. Ind. : 53, t. 160 (1864). (Plate 30 fig. 10.)

Asplenium lasiopteris (Kunze) Mett., Fil. Hort. Bot. Lips. : 78 (1856).

Asplenium thwaitesii A. Braun [in Index Sem. Hort. Berol. 1857 : 1 (1857), *nom. nud.*] ex Mett. in Abhandl. Senckenb. Naturforsch. Ges. iii : 227 (1859).—Hook., Sp. Fil. iii : 250 (1860) ; Second Cent. Ferns : t. 45 (1861).—Hook. & Bak., Synops. Fil. : 235 (1867).

Diplazium thwaitesii (A. Braun ex Mett.) Klotzsch ex T. Moore, Index Fil. : 339 (1862). —Bedd., Ferns Brit. Ind. : t. 291 (1868).

Diplazium japonicum sensu Bedd., Handb. Ferns Brit. Ind. : 180 (1883) pro parte ; non Bedd. (1876) nec *Asplenium japonicum* Thunb.

Rhizome slender, *long-creeping*, scaly. Stipes scattered, up to 30 cm. long, sometimes longer ; stipe and main rhachis villous with crisped, articulated hair-like scales mixed with thin, pale brown, lanceolate, entire scales. *Lamina* 20–45 cm. long, 8–16 cm. wide, *oblong-lanceolate*, acuminate, pinnate with 6–12 pairs of pinnae below the pinnatifid apex, lower one or two pairs of pinnae slightly reduced ; pinnae 3·5–10 cm. long, sessile or the lowermost slightly stalked, horizontal, usually cut down two-thirds or more to the rhachis into oblong, somewhat falcate, blunt segments up to 5 mm. wide, segments toothed at the apex and sometimes throughout ; veins pinnate, four to five pairs per segment, simple or forked ; costae and veins hairy above and below with minute crisped, very narrow scales. Sori in two oblique rows in each lobe, basal acroscopic ones usually diplazioid ; indusium pale brown, margins fimbriate. Spores ellipsoid to plano-convex, 40 × 30 μ, thickly and bluntly papillate, papillae 3–6 μ long.

Common in forests of the interior above 1,200 m.

CEYLON : Nilambe, Gonavy Estate, 1891, *Jeffries* (PDA). Maturata, *Freeman 187* A (BM). Badulla, *Freeman 190* D (BM). Nuwara Eliya, *Freeman 188* B, *189* C (BM). Corbet's Gap, 1,320 m. ; in secondary jungle ; 9 Dec. 1950, *Sledge 567* (BM). Horton Plains, 2,040–2,100 m., Dec. 1950, *Sledge 682, 785* (BM). Above

Le Vallon Estate, 1,500 m. ; in jungle ; 9 Feb. 1954, *Sledge 1127* (BM). *Thwaites C.P. 1343* (BM ; E ; K ; PDA—data for specimens in PDA : Murata, June 1848, *Gardner* ; Ramboda, Oct. 1853, *Gardner* ; Hunnasgiriya, Apr. 1851 ; Hantane, 1854). *T. W. Naylor Beckett 35* (BM ; E). *Wall* (E ; K). *Hutchison* (E). *Robinson 78* (K). *Ferguson* (US *815518*). *Hancock 21* (US 1277327).

Southern India.

Diplazium lasiopteris is very closely related to *D. japonicum*, differing chiefly in its more profusely scaly and villous stipe and rhachis. Ceylon plants seem to me to be identical with those from southern India whence Kunze described *D. lasiopteris*. Beddome, who united them in his *Handbook*, earlier stated (Ferns S. Ind. : 53 (1864)) that " *Asplenium Thwaitesii* ... seems hardly distinct ", and again (op. cit. : 76) " ' *D. Thwaitesii* ' ... appears to be the same as ' *D. lasiopteris* ' ". Ferguson (Ceyl. Ferns : 33 (1880)) was also quite correct in his statement that Beddome's illustration of *D. lasiopteris* (op. cit. : t. 160) represents the typical Ceylon plant better than that of *D. thwaitesii* (Ferns Brit. Ind. : t. 291 (1868)). The latter merely represents a luxuriant specimen ; I have Ceylon plants matching both illustrations and have no doubt at all that they represent growth forms of the same species. Yet it is customary to find in herbaria that Ceylon specimens are segregated under the name *D. thwaitesii* and this is no doubt due in part to Christensen's retaining this name whilst merging the other (Index Fil., Suppl. 3 : 74 (1934)) in *D. japonicum*.

The real problem is how far *Diplazium lasiopteris* and other described species within *D. japonicum sensu lato* (e.g. *D. petersenii* (Kunze) Christ described from Canton, and *D. decussatum* J. Sm. described from Nepal) are distinct from one another and from *D. japonicum sensu stricto*. The original descriptions, based on limited material, allow nothing for intraspecific variation and afford no really significant differences ; and the more ample material now available, both numerically and regionally, obscures rather than clarifies the minor differences originally attributed to plants from different geographical areas. I have not seen the type of *D. japonicum* but most Japanese specimens are much less scaly on the stipe and rhachis than South Indian and Ceylon plants, though this is not invariably the case, for a Japanese specimen at Kew collected by Matthew is shaggy with scales. Himalayan specimens of *D. japonicum* in general lack the lanceolate scales on the stipes which characterize Ceylon plants, though the crisped hair-like scales are often abundant on the main and pinna rhachides and veins. Yet other Himalayan plants seem inseparable from *D. lasiopteris*, as also do some plants from Java.

Until detailed studies are made in the field and laboratory as well as the herbarium, covering plants from many parts of its geographical area, no satisfactory treatment of the *Diplazium japonicum* complex will be possible. At present cytological information is limited to two Ceylon plants and one from Malaya where the species has only recently been found and is probably an introduction. The Malayan plant sent by Prof. Holttum as *D. japonicum* has been shown by Manton (in Phil. Trans. R. Soc., Ser. B, ccxxxviii : 138 (1954)) to be cytologically distinct from Ceylon plants, and though this cannot alone justify the application of different binomials, it seems advisable, in view of this finding and until further study clears up the relationship of Ceylon and South Indian plants with those from further north and east, to use the name originally given to Nilgiri examples.

12. **Diplazium polyrhizon** (Bak.) Sledge, comb. nov. (Plate 30 fig. 11.)

Diplazium decussatum sensu Bedd., Ferns Brit. Ind. : t. 292 (1868) ; non. J. Sm. ex Houlst. & Moore.
Asplenium polyrhizon Bak. in Hook. & Bak., Synops. Fil., ed. 2 : 490 (1874).
Diplazium japonicum Bedd., Suppl. Ferns S. Ind. Brit. Ind. : 12 (1876) pro parte ; non *Asplenium japonicum* Thunb.
Diplazium polyrhizon (Bak.) Bedd., loc. cit. (1876), *nom. syn.*

Rhizome erect. Stipes tufted, up to 30 cm. long, scaly when young with thin, pale brown, lanceolate, acuminate, entire scales, and sometimes pubescent with fine hairs. Rhachis more or less pilose with crisped, articulated, hair-like scales ; *lamina* 15–23 × 13–19 cm., *deltoid or oblong-deltoid*, pinnate with 5–10 pairs of patent pinnae below the pinnatifid apex ; pinnae up to 10 cm. long, lower shortly stalked, the rest sessile, cut down nearly to the rhachis into oblong, obtuse, entire or crenate-dentate, patent segments 5 mm. wide ; veins pinnate, 5–6 pairs per segment, simple or forked ; costae and veins sparingly hairy above and below. Sori in two oblique rows in each lobe, mostly simple, some diplazioid. Indusium pale brown, margin fimbriate. Spores ellipsoid to plano-convex, 40 × 30 μ, thickly and bluntly papillate, papillae 6 μ long.

In wet ground in forests near Nuwara Eliya. Very rare.

CEYLON : Kandapola, near Nuwara Eliya, 1,800–2,100 m. ; swampy part of the forest ; Aug. 1867, *Thwaites C.P.* 3951 (K, type ; PDA). Same locality, 1,980 m. ; in wet ground in shade ; 19 Mar. 1954, *Sledge 1320* (BM). 1870, *Robinson* (K). *Beddome* (BM ; K). *Hutchison* (E). *Wall* (E).

Endemic.

This species is confined to Ceylon, where it is very rare. The only localized station is the type locality at Kandapola near Nuwara Eliya where Dr. T. G. Walker and I refound it growing in boggy ground in deep shade. Beddome (Ferns Brit. Ind., loc. cit.) states that it occurs in the Tinnevelly hills but none of his South Indian specimens matches the Ceylon plant from which his illustration was made and these specimens are doubtless the source of his erroneous statement in his *Handbook* (p. 180) that he had " found typical *decussatum* with the rhizome creeping though it is generally erect ".

Diplazium polyrhizon differs from *D. lasiopteris* in its strictly erect rhizome, in its deltoid or oblong-deltoid fronds with the lowermost pinnae not reduced in size, in its broader more rounded and more patent pinna segments, the basal ones on the lower pinnae often being reduced in size, and in its much less scaly stipe, rhachis and under surface of the pinnae. The papillae of the spores are also rather more slender than those of *D. lasiopteris*. My Kandapola specimens all had pubescence on the stipes in addition to the scales but most herbarium specimens appear to be quite glabrous. The two species differ cytologically, *D. polyrhizon* being a tetraploid and *D. lasiopteris* a hexaploid.

13. **Diplazium beddomei** C. Chr., Index Fil. : 228 (1905). (Plate 30 fig. 12.)

Diplazium schkuhrii sensu Bedd., Ferns S. Ind. : 76, t. 230 (1864) ; Handb. Ferns Brit. Ind. : 181 (1883) ; non J. Sm.

Asplenium schkuhrii sensu Thw., Enum. Pl. Zeyl. : 385 (1864) ; non Mett.—Hook. & Bak., Synops. Fil., ed. 2 : 491 (1874).

Rhizome erect. Stipes up to 45 cm. long, thinly scaly, scales small, up to 5 mm. long, lanceolate, acute, irregularly toothed, teeth not forked, dark-coloured, intermixed with filiform hair-like scales. *Lamina* usually 30–40 cm. long, sometimes longer, 10–30 cm. wide, ovate-lanceolate or deltoid-lanceolate, *usually simply pinnate with deeply pinnatifid pinnae* or sometimes fully bipinnate ; *pinnae patent on stalks less than 1 cm. long, the lowest often opposite and deflexed* ; pinnae of simply pinnate fronds 5–10 cm. long, 2–3 cm. wide, acuminate, deeply pinnatifid, the basal *segments* standing close to the main rhachis and spreading more or less parallel to it, the rest *united by a narrow wing on each side of the pinna rhachis*, about 0·5 cm. broad, *blunt and rounded, subentire or crenate-lobate* with a decurrent hinder margin ; pinnae of bipinnate fronds up to 30 cm. long and 5–10 cm. wide, the secondary pinnae (pinnules) spaced, sessile with the *posterior margin decurrent forming a narrow wing to the pinna rhachis*, apex acute, margins bluntly crenate-lobate or pinnatifid half-way or more to the costa with obtuse or more or less truncate, entire or slightly crenate lobes ; texture firm, herbaceous ; rhachis of frond, pinnae, and costae glabrous or sparingly furnished beneath with fine hair-like scales, at least about the junction of the pinnae with the main rhachis ; veins pinnate with 1–2 pairs of simple veinlets per segment, in the larger pinnules of bipinnate fronds with 4–5 pairs of veinlets per segment, mostly soriferous. Sori extending nearly the whole length of the veinlets, basal acroscopic ones diplazioid, the rest simple. *Spores* reniform, 42 × 24 μ, with a narrow winged perispore (often lacking on the convex surface) *without surface reticulations*.

Forests of the interior from 750 to 1,650 m. Not common.

CEYLON : Ramboda ; in forests ; June 1845, *Gardner 1063* (CGE ; K ; PDA). Adam's Peak, 1,500 m. ; in forests ; Mar. 1846, *Gardner 1247* (CGE ; K ; PDA). Peacock Hill, Pussalawa, *Robinson* (K). Hakgala, *Freeman 194* B (BM). Sinha Raja Forest, above Beverley Estate, Deniyaya, 900 m., 12 Mar. 1954, *Sledge 1272* (BM). Same locality, 780 m., 4 Apr. 1954, *Sledge 1395* (BM). *Thwaites C.P. 3100* (BM ; E ; K ; PDA—data for specimens in PDA : Adam's Peak, Mar. 1846, *Gardner* ; Raxawa, Feb. 1854, *Gardner*). *Thwaites C.P. 3951* (PDA). *T. W. Naylor Beckett 31* (K). *Wall* (E ; K). *Hutchison* (E). *Beddome* (BM). *Ferguson* (US *815513*).

Endemic.

In its more frequent bipinnatifid form this species is very distinct, being easily recognized by its patent pinnae, the lowermost often opposite and deflexed, and very regular blunt and rounded segments connected by a narrow wing on each side of the pinna rhachis. Larger fully bipinnate specimens have the secondary pinnae acute at the apex and this form simulates *Diplazium decurrens* so closely that Wall, Clarke and Baker have all confused the two. Such large bipinnate fronds may be distinguished by the toothed scales, the shortly stalked pinnae (stalk at most 1 cm.), the narrow wing to the pinna rhachis, and the blunter lobes of the pinnules. The upper, less divided pinnae and the distal ends of the lower pinnae also show the characteristic rounded segments so typical of smaller fronds. In *D. decurrens* the scales are entire, the primary pinnae are longer stalked (up to 3 cm.), the pinnules more widely spaced, their decurrent posterior margins forming a continuous wing on the rhachis only between the more distally situated pinnules, and the lobes of the pinnules are often acutely toothed. The upper, less divided pinnae and the distal ends of the lower pinnae have falcate, acute, serrate, broadly adnate lobes. If any doubt remains as to identity, the very different spores, reticulate in *D. decurrens* and non-reticulate in *D. beddomei*, always afford a sure means of separation.

Beddome's illustration is poor. The frond depicted is small with the lowermost pinnae alternate as is sometimes the case. A small portion from a larger bipinnate frond is also shown though with longer stalks than is usual.

Diplazium beddomei appears to be confined to Ceylon and is not a common fern though widely distributed in the shade of moist forest in the hills of the Central and Southern Provinces.

14. **Diplazium decurrens** Bedd., Ferns S. Ind. : 76, t. 229 (1864). (Plate 30 fig. 13.)

Diplazium dilatatum var. *minus* T. Moore, Index Fil. : 327 (1861), *nom. nud.*, quoad specim. ex Ceylon.

Asplenium polypodioides var. β Thw., Enum. Pl. Zeyl. : 385 (1864).

Asplenium maximum sensu Hook. & Bak., Synops. Fil. : 239 (1867) pro parte, quoad specim. ex Ceylon ; non G. Don.

Diplazium polypodioides var. *decurrens* (Bedd.) Bedd., Handb. Ferns Brit. Ind. : 186 (1883).

Asplenium thwaitesianum Szyszyl. in G. Beck, Itin. Princ. Coburg. ii : 125 (1888).

Rhizome erect. Stipes 25–70 cm. long, scaly below, *scales* up to 6 mm. long and 1–2 mm. wide, acute, dark-coloured, margins *entire* : upper part of stipe and rhachis glabrous. Lamina ovate or deltoid-ovate, bipinnate, 30–70 cm. long, in width a half of to almost equalling the length, with about 12 pairs of alternate, ascending pinnae ; pinnae up to 50 cm. long and 15–20 cm. wide, but commonly only half as big, lower ones with stalks 1–3 cm. long ; secondary pinnae usually 2–6 cm. long but occasionally even 12 cm. long, basal ones of lower pinnae often smaller than succeeding ones, in large fronds shortly stalked, acute, shallowly or deeply pinnatifid, in smaller fronds sessile with serrate or subentire margins ; median and distal ones broadly adnate with the *posterior margin decurrent* ; apex acute, texture herbaceous, glabrous above and below ; veins pinnate in the smaller pinnules with 1–2 pairs of simple veinlets per segment, in the larger pinnatifid pinnules with 4–6 pairs of veinlets per segment ; mostly soriferous. Sori curved, extending nearly the whole length of the veinlets, at least the basal acroscopic ones diplazioid. *Spores* reniform, 45 × 27 μ, perispore forming a *reticulate* pattern of surface folds.

Forests of the interior from 600 to 1,500 m.

CEYLON : Near Patragalawe Plains ; in woods ; Mar. 1846, *Gardner 1245* (CGE ; PDA). Between Adam's Peak and Nuwara Eliya ; in forests ; Mar. 1846, *Gardner 1246* (CGE ; K). Adam's Peak ; in forest ; 14 Feb. 1908, *C. G. Matthew* (K).

Corbet's Gap, 1,200 m., 9 Dec. 1950, *Sledge 542* (BM). Above Hoolankande, 1,350 m.; forest; 20 Jan. 1954, *Sledge 1016, 1023* (BM). Gallebodde Rock, 1,200 m.; in forest; 27 Jan. 1954, *Sledge 1056* (BM). Above Le Vallon Estate, 1,500 m.; forest; 9 Feb. 1954, *Sledge 1126* (BM). Gongala Hill; in forest; 11 Mar. 1954, *Sledge 1260* (BM). Above Beverley Estate, Deniyaya, 780 m., 4 Apr. 1954, *Sledge 1404* (BM). Southern Province, 600–1,200 m., *Wall* (BM). *Thwaites C.P. 3332* (BM; E; K, type; PDA—data for specimens in PDA: Adam's Peak, *Gardner*; Ambagamuwa, Nov. 1854). *Walker* (K). *Beddome* (K). *Wall* (E). *Ferguson* (US *815499, 815509, 816418*).

Endemic.

This very distinct species has been referred both to *Diplazium polypodioides* and to *D. dilatatum* but its affinities are with neither. It comes nearest to *D. beddomei* and the larger bipinnate form of that species is sometimes so like *D. decurrens* that even Wall had " little doubt as to the two being forms of one plant " (MS. note on Kew sheet of *D. beddomei*). The spores of *D. decurrens*, however, are alone sufficient to distinguish it from any other Ceylon species. Other differences are given under *D. beddomei*.

Asplenium thwaitesianum Szyszyl. was based on a gathering of *C.P. 3332*. The type is in the Naturhistorisches Museum, Vienna. Two photographs of it in the British Museum Herbarium show that the specimen agrees with other sheets of the same number.

15. **Diplazium sylvaticum** (Bory) Sw., Synops. Fil.: 92 (1806). (Plate 30 fig. 14.)

Callipteris sylvatica Bory, Voy. Mers Afr. i: 282 (1804).
Asplenium sylvaticum (Bory) C. Presl, Rel. Haenk. i: 42 (1825).
Anisogonium sylvaticum (Bory) C. Presl, Tent. Pterid.: 116 (1836).
Allantodia pinnata Blanco, Fl. Filip., ed. 2: 571 (1845).
Microstegia sylvatica (Bory) C. Presl in Abhandl. K. Böhm. Ges. Wiss., Folge 5, vi: 450 (1851).
Diplazium elatum Fée, Mém. Fam. Foug. v: 214 (1852).
Asplenium elatum (Fée) Mett. in Abhandl. Senckenb. Naturforsch. Ges. iii: 224 (1859).
Diplazium firmum Fée, Mém. Fam. Foug. x: 30, t. 38 fig. 2 (1865).
Athyrium pinnatum (Blanco) Copel. in Philipp. Journ. Sci., Sect. C, iii: 297 (1908).

Rhizome short, erect or ascending, fronds tufted, 60–120 cm. high. Scales on lower part of stipe very dark, up to 15 mm. long and 2 mm. wide, margins toothed but not thickened, teeth often forked. Stipes up to about 40 cm. long but commonly shorter, upper part and rhachis bearing scattered, narrow, dark, toothed scales, or quite glabrous. *Lamina simply pinnate*, 50–80 cm. long and about half as wide; pinnae numerous, 12–20 pairs below the pinnatifid apex, middle and lower ones stalked; *pinnae* up to 20 cm. long and 2 cm. wide, base truncate to broadly cuneate, apex acuminate, serrate, margins *subentire or crenate-serrate or lobed* with oblique lobes about 5 mm. wide and extending about $\frac{1}{3}$ the distance to the costa; texture herbaceous; veins in pinnate groups with *3–4 pairs of lateral unbranched veinlets. Sori mostly 3–6 mm. long*, those on the lowest acroscopic veins diplazioid, the rest simple and *usually not touching the costa*, straight, *not reaching the margin*. Spores reniform, 36–42 × 21–24 μ, with a winged perispore forming anastomosing surface folds.

Forests from 600 to 1,200 m.

CEYLON: Kandy, Lady Horton's Walk, *Mrs. Chevalier* (BM). Corbet's Gap, 1,200 m., 22 Jan. 1954, *Sledge 1037* (BM). Brae Gap, Hoolankande, 1,050 m., 4 Mar. 1954, *Sledge 1234* (BM). Gongala Hill, 11 Mar. 1954, *Sledge 1286* (BM). *Gardner 34* in *Herb. T. Moore* (K). *Gardner 1059* (K). *Thwaites C.P. 1349* (BM; E; K; PDA—data for one specimen in PDA; Matale, Dec. 1845, *Gardner*). *Thwaites C.P. 3892* (CGE; K; PDA). *T. W. Naylor Beckett* (E; K). *Robinson C 77* (K). *Wall* (E). *Wight 1951* (E). *Ferguson* (US *815515*). *Hancock 53* (US *1277203*).

Mauritius, North and South India, southern China, Burma, Malaya, Java, Philippines.

Ceylon specimens agree well with examples from Mauritius, whence *Diplazium sylvaticum* was originally described. In both countries forms occur with entire and shallowly lobed pinnae. The acuminate apices of the pinnae are always serrate. In lobed forms the depth of the lobing rarely exceeds one-third the distance to the costa, but *C.P. 3892* labelled by Thwaites as a dentate variety is a remarkable form with the pinnae pinnatifid up to half-way to the costa and the lobes triangular and acute. Two specimens of *C.P. 1349* at Kew are similarly divided. These have numerous and conspicuous black scales extending up the stipe to the rhachis. They appear to represent an extreme form of *D. sylvaticum* rather than a distinct species and are well matched by a sheet from Perak in Herb. Kew (Sabang Palau; coral rock; 23 Jan. 1912, *Matthew*). Thwaites queried one of the *C.P. 1349* sheets referred to, as being *Asplenium elatum* (Fée) Mett., and Hooker and Baker (Synops. Fil.: 233 (1867)) quote this number, without query, as *A. elatum*. Fée's original description, however, and also that of Mettenius, make no reference to the distinctive features shown by Thwaites's specimens. Both quote *Gardner 34* as the type of *Diplazium elatum* and *Asplenium elatum* respectively, and the specimen of this number at Kew from Thomas Moore's herbarium is undoubtedly *D. sylvaticum*, and moreover is the form with entire or subentire pinnae. The somewhat shorter sori and more distant pinnae which Mettenius cites as distinguishing features of *Asplenium elatum* are not constant characters.

Fée's *Diplazium firmum*, based on *C.P. 1349*, also belongs here. There is nothing in his description to justify the claim that it is "absolument différente" and the illustration agrees with all specimens of *C.P. 1349* with entire pinnae in the herbaria at Kew, the British Museum and Edinburgh, which well represent Ceylon *D. sylvaticum*. Fée's illustration is in fact a much better one of this species than Beddome's (Ferns S. Ind.: t. 161 (1864)), which could well represent immature, precociously fertile *D. dilatatum*.

Diplazium sylvaticum is most likely to be confused with specimens of *D. dilatatum* bearing morphologically immature fronds in which the pinnae are pinnatifid only, though fully fertile. The distinguishing characters are given under *D. dilatatum*.

16. **Diplazium dilatatum** Bl., Enum. Pl. Jav. ii : 194 (1828). (Plate 30 fig. 15.)

Asplenium latifolium D. Don, Prodr. Fl. Nepal. : 8 (1825) ; non *A. latifolium* Bory (1803).—Hook. & Bak., Synops. Fil. : 239 (1867).
Asplenium diversifolium Wall., Numer. List : 8, n. 203 (1829), *nom. nud.* ; non *A. diversifolium* Bl. (1828).
Microstegia dilatata (Bl.) C. Presl in Abhandl. K. Böhm. Ges. Wiss., Folge 5, vi : 451 (1851).
Diplazium latifolium T. Moore, Index Fil. : 141 (1859), 331 (1861).
Asplenium dilatatum (Bl.) Hook., Sp. Fil. iii : 258 (1860).
Diplazium diversifolium J. Sm., Ferns Brit. & For. : 222 (1866), *nom. nud.*
Asplenium maximum sensu Hook. & Bak., Synops. Fil. : 239 (1867) pro parte ; non D. Don.
Athyrium dilatatum (Bl.) Holtt., Fl. Malaya ii : 574 (1954).[1]

Rhizome erect, fronds tufted, up to 1·5 m. high. *Stipes* up to 60 cm. long, *smooth*, scaly on the lower part, the *scales* up to 15 mm. long and 1 mm. wide, *dark brown with black, toothed margins*, the teeth mostly forked ; upper part of stipe and rhachis with few, scattered, narrow, black-bordered, toothed scales, becoming smooth. Lamina 60–90 cm. long and about half as wide, with 10–15 pairs of pinnae ; *fronds of two kinds, either bipinnate with elliptic or oblong pinnules, or pinnate with pinnatifid pinnae* ; transition forms also occur but fully grown plants may bear fertile fronds which are bipinnatifid only ; pinnae of bipinnate fronds up to 35 × 15 cm., lowest pinnules shortly stalked or sessile, becoming sessile then adnate below the acuminate pinnatifid apex ; pinnules up to 8 × 2 cm., oblong, base truncate or broadly cuneate, apex acute or acuminate (rounded in the distal pinnatifid pinnae), margins subentire or coarsely serrate or, rarely, pinnatifid ; costae with scattered, very narrow brown scales, especially near the base ; veins of each pinnule forming at least 10 pairs of pinnate groups, the basal acroscopic ones of each group fertile, sometimes with shorter sori on other veins, sori extending from the costa half-way or more to the margin ; lower and middle pinnae of bipinnatifid fronds up to 35 × 3–5 cm., stalked, shallowly or deeply pinnatifid below, becoming progressively less deeply lobed toward the acuminate, serrate apex ; lobes rounded, entire or nearly so, costae with scattered, very narrow, brown scales, especially near the base ; distal pinnae shallowly lobed, then serrate, then subentire below the pinnatifid frond apex ; *veins from 5–10 pairs, at least some and often many, forked*, mostly fertile with *sori up to 1 cm. long stretching from the costa to near the margin of the lobe* ; sori on basal acroscopic veinlet diplazioid, the rest not. Spores reniform, 60–70 × 30–40 μ, with a winged perispore forming a few anastomosing surface folds.

Forests from 900 to 1,650 m. Common.

CEYLON : Ramboda Pass, *Freeman 196* D (BM). Namunukula, *Freeman 201* A (BM). Namunukula, 1,350 m. ; jungle above Tonacombe Estate ; 23 Feb. 1954, *Sledge 1177, 1178, 1181* (BM). Nuwara Eliya, *Freeman 202* B (BM). Same locality, *Mrs. Chevalier* (BM). Hantane, 1,140 m., 8 Dec. 1950, *Ballard 1045* (K). Oodawella, near Kandy, 1, 200m., 8 Dec. 1950, *Sledge 529, 536* (BM). Hakgala, 1,675 m., 30 Dec. 1950, *Ballard 1347* (K). Corbet's Gap, 1,300 m., 9 Dec. 1950, *Sledge 570* (BM). Hoolankande, 1,350 m., 20 Jan. 1954, *Sledge 1002, 1003, 1004, 1006, 1024* (BM). *Thwaites C.P. 1248* (CGE ; K—data cited on specimen in CGE : forest between Adam's Peak and Nuwara Eliya, Mar. 1846). *Thwaites C.P. 1350* (E ; K ; PDA—data cited on specimens in PDA : Nuwara Eliya, 1847, *Gardner* ; Hantane, Nov. 1854). *Thwaites C.P. 1353* (E). *Gardner 1058* (BM ; CGE ; K—data cited on specimen in CGE : forests on the Ramboda Pass, June 1845). *Ferguson* (US *815496, 815508*).

---

[1] This combination is usually attributed to Milde (in Bot. Zeit. xxviii : 353 (1870)), but Milde, in the paper referred to, maintained *Diplazium* as a genus separate from *Athyrium*, although with some doubt. This is shown not only by his discussion (tom. cit. : 349–350) but also by the fact that the names of the authors following the specific epithets under his heading " *d.* Diplazium " are not enclosed in parentheses. On the other hand, under " *b.* Callipteris " and " *c.* Hemidictyum ", which he treats as subgenera (cf. tom. cit. : 350), the names following the specific epithets are enclosed in parentheses. There are also two epithets under *Diplazium* which duplicate ones under *Euathyrium*, viz. *costale* and *latifolium*, and two others duplicating ones under *Callipteris*, viz. *ambiguum* and *fraxinifolium*. (Note by R. Ross.)

South and North India, China, Indo-China, Burma, Malaya, Philippines, East Indies, northern Australia.

Blume's type specimen of *Diplazium dilatatum* from Java matches closely the common Ceylon form of the species with bipinnate fronds and subentire secondary pinnae. The bipinnate fronds normally serve to distinguish it readily from the simply pinnate *D. sylvaticum* ; but *D. dilatatum* may produce sori on fronds which are simply pinnate with pinnatifid pinnae. Such precociously fertile plants are not necessarily, or indeed usually, smaller in size than plants with bipinnate fronds, and difficulties may arise in distinguishing them from fronds of *D. sylvaticum* with shallowly lobed pinnae to which they appear to form a transition. Indeed earlier writers on Ceylon and Indian ferns, e.g. Beddome (Ferns S. Ind. : 53 (1864) ; Handb. Ferns Brit. Ind. : 188 (1883)), Ferguson (Ceyl. Ferns : 32, 35 (1880)), Wall (Cat. Ferns Indig. Ceyl. : 5 (1873)) and C. B. Clarke (in Trans. Linn. Soc., Ser. 2, Bot. i : 498 (1880)), have all expressed doubt as to the specific distinction between the two. Thus Wall wrote " the largest forms of this fern [*D. sylvaticum*] approach so closely in appearance to the simple form of *Latifolium* as to be hardly distinguishable " ; whilst Clarke maintained that " This fern [*D. sylvaticum*] appears to me only to be fronds from the young caudex (not young fronds) of *A*[*splenium*] *latifolium* ". Blume was also aware, if not of precocious fertility, at least that the bipinnate fronds of *D. dilatatum* are preceded by simpler ones, for his original description states " junioribus bipinnatifidis ".

Fertile fronds in the pinnate-bipinnatifid state have been variously misidentified. Christensen (in Contrib. U.S. Nation. Herb. xxvi : 302, t. 20 (1931)) considered it " highly probable " that the Chinese *Diplazium veitchii* Christ was a simply pinnate form of *D. dilatatum* and the Kew sheets support his view. They have also been mistaken for *D. sylvaticum*, and a plant collected in Ceylon in 1950 was identified by me and recorded (in Phil. Trans. R. Soc., Ser. B, ccxxxviii : 138 (1954)) as that species. Later I observed that its spores were indistinguishable from those of *D. dilatatum* and I have no doubt that the plant was that species in the precociously fertile condition, for I have since collected intermediates between the two types of frond.

The bipinnatifid form of *Diplazium dilatatum* may be distinguished from *D. sylvaticum* by the broader pinnae with deeper divisions, the more numerous veins which are often forked and which are mostly soriferous, bearing long and regular sori extending from the costa to near the margin, and by its spores which are nearly double the size of those of *D. sylvaticum*. In the latter the lobes rarely extend more than a third and never more than half-way to the costa, the veins are simple, and the sori are less numerous in the segments, less symmetrically disposed, and shorter.

17. **Diplazium travancoricum** Bedd., Handb. Ferns Brit. Ind. : 188 (1883). (Plate 31 fig. 16, Plate 32.)

Asplenium travancoricum (Bedd.) Bak. in Ann. of Bot. v : 310 (1891).

Rhizome erect, fronds tufted, about 1·5 m. high. Stipes up to 80 cm., lower part scaly, scales narrowly lanceolate, acuminate, 10 mm. long and 1 mm. wide, dark brown, with toothed edges ; upper part of stipe and rhachis with scattered narrow toothed scales. Lamina 70–110 cm. long and about half as wide, bipinnate with 10–15 pairs of pinnae below the pinna-like apex ; largest pinnae 30–45 cm. long and up to 15 cm. wide, stalked, lanceolate, somewhat attenuate at the base, *the upper third or half forming a long broad shallowly incised or serrate apex* with acuminate or caudate tip, pinnules subsessile or sessile, becoming adnate then decurrent, lower 2–3 smaller than the adjoining ones, the largest 5–8 cm. long and 2 cm. broad, oblong-lanceolate, entire below the acuminate, serrate tip, distal pinnules rounded above ; upper pinnae entire or nearly so, save for the acuminate serrate apex ; *frond terminating in a pinna-like apex* 10–20 cm. long which is lobed below and serrate above ; veins 15–25 pairs per pinnule, forked up to three times in the larger pinnules, mostly soriferous. Sori up to 10 mm. long, several pairs usually diplazioid. Spores 60–65 × 32–37 μ, reniform, with a winged perispore forming anastomosing surface folds.

Mountain forests. Rare.

CEYLON : Ramboda Pass, 1,720 m., 28 Dec. 1950, *Sledge 761, 762* (BM). Namunukula, 1,680 m. ; in forest ; 24 Feb. 1954, *Sledge 1197* (BM). Namunukula, Yelumali, 12 Mar. 1907, *J. M. Silva* (PDA). *Gardner 1059* (E). *Robinson 82a* (K).

South India : Athraymallay, Tinnevelly, 900–1,200 m., *Beddome* (K, type). Paupanassum Hills, Tinnevelly, *Beddome* (K). Shevagherry Hills, Aug. 1836, *Wight 3143* (K).

Diplazium travancoricum is closely allied to *D. dilatatum*, from which it is distinguished by the pinnae, which are pinnate below and rapidly change in the upper third or more to a long distal portion, the margins of which are serrate only. The frond terminates in a similar pinna-like apex. The secondary pinnae (pinnules) are entire save at their serrate tips. These characters are associated with a robust habit of growth. The two species are also cytologically distinct, *D. travancoricum* being an apogamous tetraploid and *D. dilatatum* an apogamous pentaploid.

My Namunukula and Ramboda specimens are an excellent match for Beddome's two sheets in Herb. Kew, the former especially being virtually identical with Beddome's type specimen. The robust habit emphasized by Beddome is shared by the plants from both stations.

The type specimen from Athraymallay has 15 cm. of rhachis to which three pinnae are attached. These are 45 cm. long, pinnate at the base with 20–30 pinnules, then rather quickly changing to an apical part about 15 cm. long and 3·5–4 cm. wide, which is serrate only for the greater part of its length. The pinnules are serrate only in their apical region, the proximal ones acuminate above, the distal ones rounded and obtuse. Beddome's second sheet is similar.

Beddome's description states that the "secondary pinnae" are 20–24 inches (50–60 cm.) long. This is clearly an error, primary pinnae being intended, for the normal length ratio of secondary to primary pinnae and of pinna to whole frond would otherwise imply that the primary pinnae were 3–4 m. long and the whole frond 12–20 m. high!

Growing close by my Ramboda plant was another fertile *Diplazium* (n. 762) with smaller simply pinnate fronds and broad pinnae with serrate margins. The spores of the two plants are identical. Despite their widely different appearance I consider the smaller plant a precociously fertile specimen of the same species. It is certainly not *D. sylvaticum*. *Gardner 1059* at Edinburgh matches *Sledge 762* and is doubtless also a morphologically immature specimen of *D. travancoricum*. Transitional stages between such fronds and the very large fully developed ones are probably inseparable, at least on present knowledge, from those of *D. dilatatum* and have been no doubt so named.

18. **Diplazium polypodioides** Bl., Enum. Pl. Jav. ii : 194 (1828).—Bedd., Ferns S. Ind. : 54, t. 163 (1864) ; Ferns Brit. Ind. : t. 293 (1868) ; Handb. Ferns Brit. Ind. : 184 (1883).—Posthumus in Verh. K. Akad. Wet. Amsterdam, Afd. Natuurk., Sect. 2, xxxvi, 5 : 26 (1937).—Backer & Posthumus, Varenfl. Jav. : 131 (1939). (Plate 31 fig. 17.)

Diplazium asperum Bl., tom. cit. : 195 (1828).—T. Moore, Index Fil. : 323 (1861).
Diplazium marginatum Bl., loc. cit. (1828).
Microstegia polypodioides (Bl.) C. Presl in Abhandl. K. Böhm. Ges. Wiss., Folge 5, vi : 451 (1851).
Microstegia aspera (Bl.) C. Presl, tom. cit. : 452 (1851).
Microstegia marginata (Bl.) C. Presl, loc. cit. (1851).
Asplenium polypodioides (Bl.) Mett., Fil. Hort. Bot. Lips. : 78 (1856) ; non *A. polypodioides* Sw. (1800).—Raciborski, Pterid. Fl. Buitenzorg : 227 (1898).
Asplenium asperum (Bl.) Bergsma, Cat. Fil. Hort. Bot. Rheno-Traj. : 5 (1857).
Asplenium blumei Bergsma, loc. cit. (1857).—Mett. in Abhandl. Senckenb. Naturforsch. Ges. iii : 233 (1859).
Athyrium asperum (Bl.) Copel. in Philipp. Journ. Sci., Sect. C, iii : 294 (1908).[1]—Holtt., Fl. Malaya ii : 571 (1954).
Athyrium blumei (Bergsma) Copel., loc. cit. (1908).

Rhizome stout, erect ; *stipes* up to 1 m. long, *muricate*, clothed at the base with narrow, elongate, brown *scales with black toothed borders*. Lamina bipinnate and commonly bipinnate-tripinnatifid, 60–120 cm. long and rather over half as wide ; largest pinnae 30–60 cm. long, stalked, with about 15 pairs of pinnules below the pinnatifid apex ; pinnules up to 12 cm. long and 3 cm. wide but often only half as big, shortly stalked or sessile, base truncate, apex acuminate, *edges usually lobed* $\frac{3}{4}$ *or more to the costa* but sometimes (var. *brachylobum*) only shallowly lobed ; lobes oblong, slightly oblique, *anterior margin* ± *straight, posterior margin rounded,*

---

[1] See footnote on p. 303.

edges toothed, 2–5 mm. wide; veins 6–10 pairs in deeply lobed pinnules, forked in the larger lobes, simple in the smaller ones, mostly soriferous; texture firm, herbaceous; *rhachides and costae* glabrescent or with a few small toothed scales, and *slightly muricate like the stipes*. Sori straight, 2–4 mm. long, stretching from the costa ½–¾ the way to the margin, the basal acroscopic ones diplazioid, the rest simple. Spores reniform, 45–55 × 24–27 μ, with a winged perispore.

18*a*. **Diplazium polypodioides** var. **polypodioides.**

Pinnules deeply divided.

Forests from 600 to 1,350 m. Common.

CEYLON: Adam's Peak, *Moon* (BM). Badulla, *Freeman 191* A, *192* B (BM). Madugoda, 750 m., 9 Jan. 1954, *Sledge 950* (BM). Hunnasgiriya, 870 m., 16 Jan. 1954, *Sledge 972* (BM). Gallebodde, 600 m.; near stream in jungle; 26 Jan. 1954, *Sledge 1048* (BM). Namunukula, 1,270 m.; jungle on Tonacombe Estate; 21 Feb. 1954, *Sledge 1159* (BM). Deniyaya, 900 m.; jungle above Beverley Estate; 12 Mar. 1954, *Sledge 1276* (BM). *Thwaites C.P. 1352, 1353* (BM; E; K; PDA—data for specimens in PDA: Hantane, 1847, *Gardner*; Nuwara Eliya, 1847 and 1851, *Gardner*). *Gardner 1060* (BM). *Gardner 1061* (CGE; E; K; PDA). *Gardner 1062* (BM; CGE; E; K; PDA). *Thwaites C.P. 3098* (E). *Wight 1922* (E). *T. W. Naylor Beckett 30* (BM; E). *Wall* (E; K). *Robinson 80* (K). *Ferguson* (US *815507*).

South India, Malaya, East Indies, Philippines.

18*b*. **Diplazium polypodioides** var. **brachylobum** Sledge, var. nov. Pinnulae incisae usque ad ⅓ vel minus vel raro subintegrae, aliter ut in typo.

Pinnules shallowly lobed or rarely subentire.

Mountain forests. Not common.

CEYLON: Corbet's Gap, *c.* 1,200 m., 9 Dec. 1950, *Sledge P.78* (BM, holotype). Hoolankande, 1,350 m., 20 Jan. 1954, *Sledge 1009* (BM). Central Province, 1863, *Thwaites C.P. 1352* (K). *Robinson 81* (K).

South India.

Asplenium blumei Bergsma is a *nomen novum* for *Diplazium marginatum* Bl., whose epithet could not be transferred to *Asplenium* as the combination *A. marginatum* was pre-occupied. *D. asperum* Bl. and *D. marginatum* Bl. were first united by T. Moore under the former name. Beddome (1864) united *D. polypodioides* Bl. and *D. asperum* under the name *D. polypodioides* but made no reference to *D. marginatum* nor *A. blumei* in this or any other of his works. The first to unite all three species was Posthumus in 1937, and he used the name *D. polypodioides* for the united species. This is the correct name in *Diplazium* for the species with this circumscription. Holttum accepts the same circumscription but places the species in *Athyrium* as *A. asperum*, the combination *A. polypodioides* being pre-occupied.

I agree with Posthumus and Holttum in uniting *Diplazium polypodioides* and *D. asperum.* I have examined Blume's types and find no significant difference in cutting of pinnules, venation, texture or other characters. The sheet of *D. asperum* bears a stipe which is prickly, as are the rhachis and pinna rhachides. The frond of *D. polypodioides* is without stipe but the primary and secondary rhachides are sparsely muricate, differing from *D. asperum* in this respect only in degree. Similar variations in degree of asperity of stipe and rhachides occur in Ceylon plants, selected specimens of which agree well with both of Blume's plants and with Malayan examples of *D. asperum.* North Indian plants which have been referred to *D. polypodioides* are doubtfully the same, differing—apparently constantly—in their smooth stipes.

Diplazium polypodioides is usually easily distinguished from *D. dilatatum* by its deeply lobed pinnules and this character has often been used in keys for their separation. In Ceylon, however, the pinnules of *D. polypodioides* are not always deeply divided and Beddome (Handb. Ferns Brit. Ind. : 184 (1883)) was quite correct when he wrote " sometimes only ⅓ down ". The condition with shallow lobes, which I distinguish as var. *brachylobum,* is not so obviously different from the more divided forms of *D. dilatatum* and has sometimes been confused with that species. In such plants the muricate stipe and rhachides provide a convenient and reliable means of distinguishing *D. polypodioides,* for murications are invariably present, even if sometimes very sparse. In *D. dilatatum* the extreme base of the stipe is sometimes rough but the middle and upper parts and the rhachis are always quite smooth. The spores of *D. dilatatum* are larger with a wider and more conspicuously crisped perispore. Extreme examples of var. *brachylobum* are *Abrahams 651* from Travancore and *Robinson 81* from Ceylon, both in the Kew Herbarium, in which the pinnules are subentire. One of the Kew sheets of *Thwaites C.P. 1352,* a small frond less than 60 cm. tall but with muricate stipes, similarly has the secondary pinnae only serrate or dentate. It has been labelled by Thwaites " forma minus compositus " and is here referred to var. *brachylobum.* Despite the distinctive appearance of such plants their other characters all agree with typical *D. polypodioides.* It is possible that these may represent precociously fertile plants comparable with those described in *D. dilatatum.*

19. **Diplazium cognatum** (Hieron.) Sledge, comb. nov. (Plate 31 fig. 18.)

Asplenium assimile sensu T. Moore, Index Fil. : 114 (1859) pro parte ; non Endl.

Asplenium australe sensu Hook., Sp. Fil. iii : 232 (1860) pro parte ; non Brackenr.—Thw., Enum. Pl. Zeyl. : 385 (1864).

Diplazium assimile Bedd., Ferns Brit. Ind. : t. 294 (1868) pro parte ; non *Asplenium assimile* Endl.

Asplenium umbrosum var. *assimile* Bak. in Hook. & Bak., Synops. Fil., ed. 2 : 489 (1874) pro parte quoad ref. Bedd. et specim. ex Ceylon ; non *Asplenium assimile* Endl.

Athyrium assimile sensu Bedd., Suppl. Ferns S. Ind. Brit. Ind. : 12 (1876) ; non C. Presl.

Diplazium umbrosum var. *assimile* Bedd., Handb. Ferns Brit. Ind. : 190 (1883) pro parte ; non *Asplenium assimile* Endl.

Athyrium cognatum Hieron. in Hedwigia lix : 321 (1917).

Rhizome creeping. Stipes up to 60 cm. long, scaly at the base. *Scales* narrowly linear, *entire, brown,* about 5 mm. long. *Fronds deltoid, tripinnate-quadripinnatifid,* glabrous, thin and membranous in texture ; lower pinnae stalked, up to 30 (rarely 40) cm. long and 15–20 cm. wide ; secondary pinnae 10 cm. long, 3–4 cm. wide, gradually acuminate ; tertiary pinnae very shortly stalked below, adnate and decurrent above, apex blunt, divided ½–⅔ or more of the way to the costa into about five segments on each side, *segments small, slightly falcate, entire or with one or two teeth on the anterior margin and more rarely on the posterior margin* ; veins pinnate in the segments, the anterior one in each segment bearing an oblique diplazioid sorus stretching from the midrib, the other veins also soriferous in the larger segments. Spores plano-convex, 30 × 21–24 μ, spinulose.

Forests of the interior from 600 to 1,500 m. Rare.

CEYLON : Pittawella, Matale, 600 m., *Wall* (BM). *Thwaites C.P. 1347* (BM ; E ; K ; PDA—data for specimens in PDA : Dimboola, June 1848 ; Haputale, Apr., May 1856). *Hutchison* (E). *Ferguson* (US *815519*).

Endemic.

A very distinct species resembling the Norfolk Island and Australian *Diplazium assimile* (Endl.) Bedd., from which it differs in the tertiary pinnae which are pinnatifid with laterally toothed lobes, whereas in *D. assimile* they are subentire or lobed, not pinnatifid, and the lobes (when present) are entire or with one or two teeth at the apex. The most striking difference however is in the spores, which are spiny in *D. cognatum* and smooth with a narrow perispore in *D. assimile.* It differs from *D. muricatum* in its deltoid, more dissected fronds of thin and flaccid texture, its smaller ultimate divisions, its non-allantodioid sori and its very different spores. Beddome rightly referred this to the genus *Diplazium* and both Wall (Cat. Ferns Indig. Ceyl. : 5 (1873)) and Ferguson (Ceyl. Ferns : 31 (1880)), who knew the living plant, were emphatic that it did not belong to *Asplenium australe* as classified in the *Species Filicum,* which Thwaites followed in his *Enumeratio.* Wall states that it " is undoubtedly a *Diplazium* " and Ferguson that " it is a distinct and well-marked species which cannot be confounded with an Athyrium nor with any of our Diplaziums ".

Diplazium cognatum is confined to Ceylon and is a rare species there. I have not met with it, but examination of the numerous gatherings at Kew, the British Museum and Edinburgh fully confirms the views of Beddome, Wall and Ferguson as to its distinctness and generic position. Mettenius first distinguished the Ceylon plant under *Asplenium,* and suggested the epithet " *cognatum* " without publishing a description. Hieronymus, however, is the author of the species.

Sect. ANISOGONIUM (C. Presl) Sledge, stat. nov.

Anisogonium C. Presl, Tent. Pterid. : 115 (1836).

Veins anastomosing. Type : *D. fraxinifolium* C. Presl (*Anisogonium fraxinifolium* (C. Presl) C. Presl).

20. **Diplazium esculentum** (Retz.) Sw. in Schrad., Journ. Bot. 1801, i : 312 (1803). (Plate 31 fig. 19.)

Hemionitis esculenta Retz., Obs. Bot. vi : 38 (1791).
Asplenium ambiguum Sw. in Schrad., Journ. Bot. 1800, ii : 54 (1801).
Asplenium esculentum (Retz.) C. Presl, Rel. Haenk. i : 45 (1825).—Hook., Sp. Fil. iii : 268 (1860).—Hook. & Bak., Synops. Fil. : 244 (1867).
Anisogonium esculentum (Retz.) C. Presl, Tent. Pterid. : 116 (1836).—Bedd., Handb. Ferns Brit. Ind. : 192 (1883).
Microstegia esculenta (Retz.) C. Presl in Abhandl. K. Böhm. Ges. Wiss., Folge 5, vi : 451 (1851).
Callipteris esculenta (Retz.) J. Sm. apud Houlst. & Moore in Gard. Mag. Bot. [iii] : 265 (1851).—Bedd., Ferns S. Ind. : 54, t. 164 (1864).
Digrammaria esculenta (Retz.) Fée, Mém. Fam. Foug. v : 217 (1852).
Callipteris ambigua (Sw.) T. Moore, Index Fil. : lv (1857), 216 (1860).
Athyrium esculentum (Retz.) Copel. in Philipp. Journ. Sci., Sect. C, iii : 295 (1908).—Holtt., Fl. Malaya ii : 562 (1954).

Rhizome erect. *Stipes* 30–60 cm. long, scaly at the base, otherwise *smooth* ; scales about 10 mm. long and 1 mm. wide, with toothed edges. Lamina bipinnate, 1 m. or more long and about half as wide ; lower pinnae 40–50 cm. long, 15 cm. wide ; *pinnules* 5–10 cm. long, 1–2 cm. wide, lowest shortly stalked, the rest sessile, base truncate or broadly cuneate, *often auricled on one or both sides at the base,* margins crenate or shallowly lobed, the lobes toothed, apex acuminate, serrate ; *veins* pinnate, 6–10 pairs per lobe, the lower 2–3 pairs of adjacent groups *anastomosing, forming an irregular excurrent vein to the sinus between the lobes* ; texture herbaceous ; rhachis glabrescent, costae usually bearing scattered small, ovate, toothed scales beneath. Sori often on all the lateral veins and extending along nearly their whole length, basal acroscopic ones diplazioid. Spores reniform, 42–45 × 26–29 μ, without a perispore.

On river banks and in wet open places below 900 m. Common.

CEYLON : Kandy, *Robinson 68* (K). Badulla, *Freeman 203* A, *204* B, *205* C (BM). Kelani River, near Colombo, *Mrs. Chevalier* (BM). Near Galle ; in open forests ; Apr. 1844, *Gardner 1058* (CGE). Near Ratnapura, 30 m. ; moist ground by road ; 13 Mar. 1954, *Sledge 1288* (BM). *Thwaites C.P. 3270* (E ; K ; PDA—data for specimens in PDA : Ratnapura, Apr. 1855 ; Galle). *Robinson 83, 84* (K). *T. W. Naylor Beckett* (K). 1837, *Wight 133* (E). *Ferguson* (US *815483, 815484*).

Throughout India, south China, Formosa, Malaysia east to Philippines, New Guinea, Samoa.

21. **Diplazium paradoxum** Fée, Mém. Fam. Foug. v : 214 (1852). (Plate 31 fig. 20.)

Asplenium heteropteron Mett. in Abhandl. Senckenb. Naturforsch. Ges. iii : 218 (1859).
Callipteris paradoxa (Fée) T. Moore, Index Fil. : 217 (1861).
Asplenium smithianum Bak. in Hook. & Bak., Synops. Fil. : 245 (1867).
Callipteris smithiana (Bak.) Bedd., Ferns Brit. Ind. : t. 332 (1870).
Anisogonium smithianum (Bak.) Bedd., Handb. Ferns Brit. Ind. : 192 (1883).
Diplazium smithianum (Bak.) Diels in Engler & Prantl, Nat. Pflanzenfam. i, 4 : 228 (1899) ; non *D. smithianum* Kunze (1848).

Rhizome oblique, decumbent. *Stipes* 30 cm. long, *muricate*, scaly below and furfuraceous throughout, scales 10 mm. long, narrow, brown, margins toothed but not blackened, teeth forked. Lamina bipinnate, broadly ovate to deltoid-ovate, up to 60–70 cm. long, lower pinnae pinnate, median ones pinnatifid becoming serrate only beneath the pinnatifid frond apex; largest pinnae up to 45 cm. long and 15 cm. broad, *pinnules* oblong, 5–10 × 1–2 cm., sessile and broadly cuneate to subtruncate below, apex serrate, *rather abruptly acuminate*, margins usually entire, in large fronds serrate-dentate or even shallowly pinnatifid; texture firm, herbaceous; both surfaces naked but main rhachis and rhachis of lower pinnae thinly furfuraceous and *often sparsely muricate*; veins 2–6 pairs in each group, the *basal acroscopic one* (or sometimes two) *fusing with the basiscopic vein of the next group about half-way or more between the costa and margin.* Sori elongate, up to 7 mm. long, basal acroscopic ones diplazioid. Spores reniform, 39–42 × 21–24 μ, with a perispore.

Forests of the Central Province. Not common.

CEYLON: Hantane Range; in forests; Aug. 1844, *Gardner 1060* (BM; CGE; K; PDA). Lagalla, 900 m., *T. W. Naylor Beckett 33* (K). Central Province; sides of streams; *T. W. Naylor Beckett 34* (BM). Oodawella, near Kandy, *Robinson 70* (K). *Thwaites C.P. 1350* (BM; E; PDA—data for specimen in PDA: Hantane, 1850). *Thwaites C.P. 3990* (K; PDA—data for specimen in PDA: Matale East, Apr. 1869, *T. W. Naylor Beckett*). *Gardner 1058* (BM). *Gardner 1351* (K, type of *Asplenium smithianum*). *Robinson C 82* (K). *Beddome* (BM; K). *Wall* (E; K). 1829, *Macrae* ex *Lindley* (K). *Wight 1921* (E). 1899, *Anderson* (E). *Ferguson* (US *815514*).

Endemic.

There can be no doubt that Fée's description of *Diplazium paradoxum*, based on a Ceylon gathering by Gardner, refers to the same species as that later named *Asplenium smithianum* by Baker, for though Fée described it under *Diplazium*, generically characterized by him as having free veins, he yet states that the veins are " tunc liberis, ut in Diplazio, tunc coalitis, ut in Callipteride ". In other respects his description agrees with herbarium material which displays considerable variation even in pinnae on the same frond in the frequency or otherwise with which anastomosis of the veins occurs; a fact also commented upon by Fée in the discussion following his description. No doubt the stipe was absent in the specimen of Gardner's from which the description was drawn up, as it is also in the three sheets of Gardner's in Herb. Kew, and hence the absence of any allusion to the characteristic and well-marked murications. Mettenius renamed the plant *Asplenium heteropteron*, quoting Fée's description in synonymy and even using Fée's epithet in his key (p. 80) in the same work; the combination *A. paradoxum* was pre-occupied.

Diplazium paradoxum resembles *D. dilatatum* but is easily distinguished by its muricate stipes and anastomosing veins. It is most like *D. spinulosum* Bl. (*Callipteris spinulosa* (Bl.) J. Sm.) from Celebes and New Guinea, which differs in its larger size, more copiously anastomosing veins and less abruptly contracted apices of the pinnae. The Malayan *D. insigne* Holtt. is still larger, with pinnules adnate to the rhachis, and the stipe is muricate only in the lower part.

Subgen. PSEUDALLANTODIA (C. B. Clarke) Sledge, comb. nov.

Asplenium subgen. *Pseudallantodia* C. B. Clarke in Trans. Linn. Soc. Lond., Ser. 2, Bot. i : 495 (1880).

Veins free. Sori oblong or subquadrate, tumid (allantodioid), rarely placed back to back. Indusium thin and fragile, usually bursting dorsally to expose the sporangia. Type : *Asplenium procerum* (Hook. & Bak.) Wall. ex C. B. Clarke (=*D. muricatum* (Mett.) Alderw. van Rosenb.).

This subgenus includes species referred by T. Moore both to *Asplenium* sect. *Allantodia* (Index Fil. : xlix (1857)) and to *Diplazium* sect. *Didymochlamys* (op. cit. : lv (1857)). Under the latter he cites *D. tumulosum* T. Moore (=*D. hians* Kunze) and *D. athyrioides* T. Moore (=*D. expansum* Willd.) as examples and the former seems a typical *Pseudallantodia*. One of the Kew sheets (Colombia, *Linden 32*) has been annotated " *Allantodia* vera. Indusium bursting irregularly ". *D. expansum*, however, seems to me a typical member of *Diplazium* subgen. *Diplazium*.

22. **Diplazium muricatum** (Mett.) Alderw. van Rosenb., Malayan Ferns : 829 (1909). (Plate 31 fig. 21.)

Asplenium procerum Wall., Numer. List : 66, n. 2203 (1830), *nom. nud.*

Athyrium gymnogrammoides Bedd., Ferns S. Ind. : 52, t. 156 (1864) pro parte, quoad descr. et fig. ; Handb. Ferns Brit. Ind. : 168 (1883) ; non *Asplenium gymnogrammoides* Klotzsch ex Mett.

Athyrium australe sensu Bedd., Ferns S. Ind. : 52, t. 158 (1864) ; non Brackenr.

Asplenium gymnogrammoides sensu Thw., Enum. Pl. Zeyl. : 385 (1864) pro parte ; non Klotzsch ex Mett.

Asplenium muricatum Mett. in Ann. Mus. Bot. Lugd.-Bat. ii : 239 (1866).

Athyrium procerum Milde in Bot. Zeit. xxiv : 376 (1866), *nom. nud.*

Asplenium umbrosum var. *procerum* Hook. & Bak., Synops. Fil., ed. 2 : 489 (1874).

Asplenium procerum (Hook. & Bak.) Wall. ex C. B. Clarke in Trans. Linn. Soc. Lond., Ser. 2, Bot. i : 495 (1880) ; non *A. procerum* Bernh. (1802).

Diplazium umbrosum var. *australe* Bedd., Handb. Ferns Brit. Ind. : 189 (1883) pro parte ; non *Allantodia australis* R. Br.

Diplazium umbrosum var. *procerum* (Hook. & Bak.) Bedd., loc. cit. (1883).

Athyrium procerum (Hook. & Bak.) Milde ex C. Chr., Index Fil. : 145 (1905).

Athyrium umbrosum var. *muricatum* (Mett.) C. Chr., op. cit., Suppl. 1 : 97 (1913).

Athyrium muricatum (Mett.) C. Chr., op. cit., Suppl. 3 : 43 (1934).

Rhizome creeping. *Stipes* up to 1 m. long, *usually somewhat muricate*, when young sparsely clad *with ovate, thin, brown, deciduous scales. Lamina* broadly ovate, *bipinnate-tripinnatifid or tripinnate-quadripinnatifid*, 40–90 cm. long, pinnate to apex ; largest pinnae in tripinnate-quadripinnatifid fronds up to 60 cm. long and 30 cm. wide; pinnules (secondary pinnae) stalked, in tripinnate fronds up to 18 cm. long and 6 cm. wide, oblong-lanceolate, apex acuminate, the tertiary pinnae up to 3 cm. long with acroscopic base truncate and basiscopic base cuneate, apex acute, margins lobed $\frac{1}{3}$–$\frac{1}{2}$ to the costa, lobes 3 mm. wide at base, falcate-rounded with toothed edges ; in smaller bipinnate fronds the secondary pinnae scarcely exceeding 3 cm. long and 1 cm. wide, lobed almost to the costa, the lobes 4–5 mm. wide at the base, oblong, obtuse, margins usually serrate at least above ; veins forked ;

partial rhachis and costa bearing ovate-acute, entire, brown scales beneath; texture firm, herbaceous. *Sori allantodioid, short,* oblong or subquadrate, *1–3 mm. long,* not curved, *forming two rows close to the costa,* sometimes with additional sori in the ultimate segments; basal acroscopic sori often diplazioid, the rest single. Indusium thin, membranous. Spores reniform, 40–55 × 25–30 μ, with a winged perispore.

Forests of the high mountains above 1,800 m.

CEYLON: Nuwara Eliya; in woods; Sept. 1844, *Gardner 1066* (CGE; K). Same locality, *Freeman 176* A, *180* E, *199* A, *200* B (BM). Horton Plains, 2,100 m., 30 Dec. 1950, *Sledge 786* (BM). Namunukula, 1,920 m., 24 Feb. 1954, *Sledge 1189* (BM). Ramboda Pass, 1,920 m.; by track to Maturata; 17 Mar. 1954, *Sledge 1313* (BM). Adam's Peak, Mar. 1845; Nuwara Eliya, Jan. 1847; Udapussalawa, Apr. 1854; *Gardner 1069* = *Thwaites C.P. 1344* in part (PDA). *Thwaites C.P. 1344* (E). *Walker* (K). *Wall* (E). *Hutchison* (E).

South India (Nilgiri and Palni Hills), Nepal, Sikkim, Bhutan, Khasi and Naga Hills, Burma, Siam, Formosa, Java.

Mettenius's description of *Asplenium muricatum* as having sori close to the costae and with a thin, pale, membranous indusium, and his statement that his species is allied to *A. brownii* J. Sm., fix the plant as one of the group of species with allantodioid sori. The type specimen is at Leyden and is certainly identical with the Ceylon plant. Mettenius cited the type as "*Aspidium costale* Blum. herb." and the sheet (n. 908324-171) has been erroneously designated the type of *Aspidium costale* Bl., though the identification as such is in Miquel's handwriting and not Blume's. Mettenius has labelled the sheet "*Asplenium muricatum* M. Java". A further identification as *Allantodia montana*—a manuscript name—was attributed by Mettenius to Zippelius, but this identification, together with a description and comparison with related species, is clearly Blume's as the comparison refers to the differences from "*Allantodia sylvatica* Nob.", an annotation which could only have been made by the author of that species. Moreover the specimen does not agree with Blume's description of his *Aspidium costale* and quite clearly belongs to *Allantodia* and not *Aspidium* as those genera were construed by Blume. *Athyrium procerum* Milde, which I consider synonymous with *Diplazium muricatum*, was published in the same year but not validly as Milde merely transferred Wallich's manuscript name from *Asplenium* to *Athyrium* without description.

In Ceylon specimens of *Diplazium muricatum* the stipes are usually somewhat muricate but not invariably so. Some specimens of *Athyrium procerum* from the Himalaya (e.g. *Clarke 36529*, *Gamble 7097* in Herb. Kew) have markedly asperous stipes but in other gatherings they are smooth. The Himalayan plant differs from that of South India, Ceylon and Java in the much weaker development of scales on the costae and at the junction of pinnule and pinna rhachis but, though it is often apparently quite devoid of scales, a few are usually to be found on close inspection, and occasionally (e.g. *Clarke 27342* in Herb. Brit. Mus.) they are more numerous. Himalayan plants also are tripinnate-quadripinnatifid and South Indian ones bipinnate-tripinnatifid with broader ultimate segments, but in Ceylon populations, where fronds vary from 60–180 cm. in height and 30–120 cm. in width, both degrees of pinnation occur and the scales agree in form and degree of development with South Indian plants though the cutting of the fronds agrees better with North Indian ones. It does not seem possible to make any satisfactory subdivision, and both North and South Indian plants must, I think, be referred to the same species.

Beddome (Handb. Ferns Brit. Ind. : 189 (1883)) referred the Nilgiri plant to *Diplazium umbrosum* var. *australe*, erroneously including C. B. Clarke's *Asplenium bellum*, which has erect rhizomes, and *A. multicaudatum* var. *triste* C. B. Clarke, which has non-allantodioid sori, as synonyms. The Himalayan plant he referred to *D. umbrosum* var. *procerum*. His specimen and illustration (Ferns S. Ind. : t. 158 (1864)) of the former represent an unusually small frond, smaller than any of the fourteen other sheets from South India at Kew. The fern he depicted as *Athyrium gymnogrammoides* (Ferns S. Ind. : t. 156 (1864)), despite its widely different appearance, is, as the specimen preserved at Kew proves, a pinna from a large tripinnate frond of the same species. The characteristic scales on the secondary rhachides and costae which are well shown in t. 158 are omitted from t. 156 though the specimen demonstrates clearly enough their presence. The sori in the specimen depicted in t. 156 are too old to show their allantodioid form and have by assumption been represented by the artist as athyrioid. The lobing of the pinnules and toothed ultimate segments as represented in the drawings of individual pinnules in the two plates are identical. As I have pointed out elsewhere (in Ann. & Mag. Nat. Hist., Ser. 12, ix : 459 (1956)), Beddome was misled by Thwaites, who sent him this specimen as the Ceylon *Asplenium gymnogrammoides*, and he failed to recognize its identity with the Indian species. Thus, although his new combination *Athyrium gymnogrammoides* is based on *Asplenium gymnogrammoides* Klotzsch ex Mett. and is hence a synonym of *Athyrium solenopteris* var. *pusillum*, the description and figure accompanying it apply entirely to *D. muricatum*.

Diplazium muricatum resembles *Athyrium australe*. Both species have tumid sori, covered when young by very thin indusia which wrap completely round the sporangia and fragment along their summits when the sporangia are ripe, instead of curling backwards as is usual in *Athyrium* and *Diplazium*. The form of the sorus is similar to that of *Diplaziopsis* and on this ground C. B. Clarke proposed *Pseudallantodia* as a subgenus. Beddome (Ferns S. Ind. : 52 (1864)) also referred to the indusium as being like that of *Allantodia* and stated that " it has hardly a right to a place in Asplenium, Athyrium, or Diplazium, and would be better placed next to Allantodia in a genus distinguished by free venation ". Other species of *Athyrium* and *Diplazium*, e.g. *A. umbrosum* (Ait.) C. Presl, *D. procumbens* Holtt. and *D. urticifolium* Christ, have this distinctive form of sorus, and *Pseudallantodia* may merit generic rank, though a detailed comparison of soral structure and development in more species of the group is required before any firm decision can be reached.

The type specimen of *Allantodia australis* in the British Museum Herbarium does not have costal sori and in most Australian and New Zealand specimens named *Athyrium australe* the sori are not contiguous to the costae though their degree of dispersal varies. The fronds are greener and more membranous and flaccid in texture with few or no scales beneath. It is probable that more than one species is included under the name *A. australe* in Australia and New Zealand. No rhizomes are represented in herbarium material at Kew or the British Museum, but a living plant from Australia in cultivation at Kew differs markedly from *Diplazium muricatum* in its erect rhizome. Brownlie (in Trans. R. Soc. New Zeal. lxxxv : 213–216 (1958)) found the New Zealand " *Athyrium australe* " to be a hexaploid with $n = 123$ chromosomes. The Ceylon plant is a tetraploid with $n = 82$. Brownlie's count also provides cytological evidence that the New Zealand plant belongs to *Diplazium* rather than *Athyrium*.

The Ceylon species which *Diplazium muricatum* resembles most closely is *D. procumbens*, but the secondary pinnae of the latter are broader and thinner in texture with wider and more broadly rounded segments and longer, diverging sori covered, when young, with indusia, which are so thin and fragile that the sporangia are visible through them. The characteristic scales on the under sides of the pinnules and pinna rhachides in *D. muricatum* are absent in *D. procumbens*, or such few scales as are present are narrower and have toothed margins. In *D. muricatum* also the lamina and pinnae even in small fronds are pinnate almost to their extremities while in *D. procumbens* the fronds and pinnae are only pinnatifid in their upper parts.

The type specimen of *Diplazium muricatum* at Leyden is the only known example from Java. There are no other specimens from there at Leyden and Prof. Holttum has searched for but failed to find any sheets so identified at Bogor; nor are there any specimens from Java or elsewhere in Indonesia or Malaya at Kew or the British Museum. Backer and Posthumus (Varenfl. Java (1939)) make no reference to this species, which is certainly not included in their *D. umbrosum*, described as having an erect rhizome and sori reaching from the midrib to near the edge of the pinnules. The Leyden sheets from Java named *D. umbrosum* represent another species, unrelated to *D. muricatum* and indeed to the true Madeira *Athyrium umbrosum* (*D. umbrosum* (Ait.) Bedd., non Willd.). A specimen of *D. muricatum* from Burma (*Lace 4982* in Herb. Kew) and another from Siam (*Hosseus 348a* in Rijksmus., Leyden) are clearly identical with Indian plants. The distribution of *D. muricatum* parallels that of *Diplaziopsis javanica*, which is likewise common to Java, Ceylon and North India and absent from Malaya but differs in occurring in South India. *Doodia dives* and *Ctenitis rufescens* are also common to Ceylon and Java, but they are absent from both India and Malaya.

23. **Diplazium procumbens** Holtt. in Gard. Bull. Str. Settl. xi : 95, fig. 4 (1940). (Plate 31 fig. 22.)

Athyrium procumbens (Holtt.) Holtt., Fl. Malaya ii : 572 (1954).

Rhizome creeping, black. Stipes up to 75 cm. long, black at the base, slightly muricate below, when young sparsely clad with small, brown, toothed scales. *Lamina* broadly ovate or deltoid-ovate, *bipinnate*, up to 70 cm. long and 60 cm. wide, largest pinnae 45 cm. long and 20 cm. wide ; *pinnules* shortly stalked below, becoming sessile then adnate upwards, 6–12 cm. long and 1·5–3 cm. wide, base truncate, apex acuminate, *pinnatifid from* $\frac{1}{3}$–$\frac{2}{3}$ *to the costa, lobes 5–8 mm. wide at the base, broadly truncate-rounded, margins entire or slightly toothed towards the apex* ; veins 4–7 pairs per lobe, simple or, in the larger lobes, forked ; rhachis and costae usually bearing scattered, *elongate, narrow*, brown, *sparsely toothed scales*, especially about the junction of pinnule and pinna rhachis. *Sori allantodioid,* narrow, *3–6 mm. long, diverging from the costae* and spreading along the veins for ⅓–½ or more their length, basal acroscopic ones diplazioid. *Indusium very thin, whitish.* Spores reniform, 50–60 × 30–33 μ, some circular, 45–48 μ, with a winged perispore.

Mountain forests at 1,350–1,950 m. Rare.

Ceylon: Hakgala, 1,800 m., 23 Dec. 1950, *Holttum 39173* (SING). Hoolankande, 1,350 m.; in jungle bordering path; 20 Jan. 1954, *Sledge 1005* (BM). Namunukula, 1,920 m.; in forest; 24 Feb. 1954, *Sledge 1192* (BM). Pallagalla, Oct. 1853, *Thwaites C.P. 1350, 1352* (PDA). *Thwaites 103* (PDA). *Thwaites C.P. 1353* (E). *Thwaites C.P. 3098* (BM). *Trimen* in *Thwaites C.P. 3100* in *Herb. Beddome* (K). 1899, *Anderson* (E). *Palliser* (US *684019*).

Malaya.

Diplazium procumbens has been known hitherto only from the original Malayan station at Fraser's Hill, Pahang. Ceylon specimens agree so closely in all respects with Holttum's specimens that I have no doubt as to their being the same species. Both have been in cultivation at Kew and both have been examined cytologically by Prof. Manton and found to be apogamous triploids. *D. muricatum* is a sexual tetraploid. The spherical spores intermixed with plano-convex ones appear to be the product of sporangia in which a reduced number of divisions of spore mother-cells occur. They are present in *C.P. 3098* (Herb. Brit. Mus.) as well as my own gatherings though not in Holttum's type specimen.

The differences between these species are noted under *D. muricatum.* Both have been confused in the past with other large species of *Diplazium* though both differ markedly from all these in their strongly creeping rhizomes. In the absence of rhizomes, their tumid, allantodioid sori with the margins tucked under the developing sporangia are sufficient to distinguish them from other species, and even old specimens of *D. procumbens,* in which this feature is no longer observable, can be recognized by the remarkably thin, fragile, usually whitish indusia. *D. procumbens* is evidently a rare species in Ceylon judging from the few specimens present in herbaria.

Name of uncertain application

Diplazium katzeri Regel in Gartenflora ix: 35, t. 282 (1860).

Regel's species was based on a plant raised from spores obtained from Ceylon. His illustration depicts a simply pinnate frond with lobed pinnae: his description is worthless. Christensen (Index Fil., Suppl. 3: 73 (1934)) equated *D. katzeri* with *D. elatum* Fée, which is a form of *D. sylvaticum.* There is an authentic garden specimen from St. Petersburg sent by Regel to Thomas Moore at Kew and this represents in my opinion a pinna and not a frond, though no attachment to the rhachis is present. The pinnae, whether primary or secondary, do not tally with Regel's illustration. The specimen matches most closely the pinna of *Wight 3143,* which I refer to *D. travancoricum,* and the toothed, black-edged scales, spore size and perispore characters agree with those of *D. dilatatum* and *D. travancoricum.* It seems probable therefore that Regel described *D. katzeri* from a precociously fertile frond of one of these two species, both of which may produce sori when simply pinnate. The specimen sent later to Moore could well have come from a mature bipinnate frond of the same plant as that originally described in an immature, simply pinnate condition.

DIPLAZIOPSIS C. Chr.

Rhizome short, ascending, clothed with brown, entire scales. Fronds simply pinnate, glabrous; veins anastomosing about half-way to the margin and forming two or three rows of elongate, more or less hexagonal areolae in the marginal half of the lamina. Sori linear-oblong, allantodioid, attached to the vein between the costa and first anastomosis. Indusium very thin, fastened round the receptacle and quite enclosing the sorus when young, usually rupturing irregularly when the spores mature, or sometimes asplenioid. Type: *Asplenium javanicum* Bl. (=*D. javanica* (Bl.) C. Chr.).

24. **Diplaziopsis javanica** (Bl.) C. Chr., Index Fil.: 227 (1905). (Plate 31 fig. 23.)

Asplenium javanicum Bl., Enum. Pl. Jav. ii: 175 (1828).
Allantodia brunoniana Wall., Pl. As. Rar. i: 44 (1830).—Bedd., Ferns S. Ind.: 52, t. 159 (1864).—Hook. & Bak., Synops. Fil.: 246 (1867).
Hemidictyum brunonianum (Wall.) C. Presl, Tent. Pterid.: 111 (1836) (" *Brunonis* ").
Asplenium brunonianum (Wall.) Mett., Fil. Hort. Bot. Lips.: 71 (1856).
Athyrium brunonianum (Wall.) Milde in Bot. Zeit. xxviii: 353 (1870).
Allantodia javanica (Bl.) Trév. in Nuov. Giorn. Bot. Ital. vii: 159 (1875).—Bedd., Handb. Ferns Brit. Ind.: 195 (1883).
Diplazium javanicum (Bl.) Makino in Bot. Mag. Tōkyō xx: 85 (1906).
Athyrium javanicum (Bl.) Copel. in Univ. Calif. Publ. Bot. xvi: 70 (1929).

Stipes to 30 cm. long, scaly at the base, glabrous above. Lamina up to 60 cm. long and 30 cm. wide, simply pinnate with about twelve pairs of pinnae and with a terminal pinna similar to the others; pinnae 10–17 × 2·5–4 cm., sessile or nearly so, oblong, base truncate, margins entire or slightly crenulate towards the caudate apex, glabrous above and below; texture thin, herbaceous; veins forked near the midrib with sori confined to the anterior vein of the fork. Spores ellipsoid, 36 × 27 μ, with a winged perispore forming anastomosing surface folds.

Forests of the Central and Southern Provinces at 600–1,200 m.

CEYLON: Hantane Range, Oct. 1844, *Gardner 1057* (BM; CGE; K). Nuwara Eliya, *Freeman 206* A (BM). Nillumalle, Madulkelle, Oct. 1887 (PDA). Deniyaya, 900 m.; forest above Beverley Estate; 12 Mar. 1954, *Sledge 1275* (BM). *Thwaites C.P. 2543* (BM; CGE; PDA—data for specimens in PDA: Palagalla, Oct. 1853; Hantane, Jan. 1854). *Robinson C 84* (K). *Hance 12* (BM). *T. W. Naylor Beckett 79* (BM). *Wall* (K). Ex *Herb. Hooker* (BM; CGE).

North India from Nepal to Assam, Yunnan, Tonkin, Formosa, Philippines, Java, Sumatra, Borneo, New Guinea, Samoa, Fiji, Tahiti, New Caledonia.

APPENDIX

DIPLAZIUM SPECIMENS DISTRIBUTED BY GARDNER AND THWAITES

Gardner and Thwaites both issued sets of numbered specimens. In Gardner's exsiccata the ferns are covered by the numbers *1053–1271* though a few later numbers are attributed to Gardner in Hooker's *Species Filicum*. Thwaites's *C.P.* (Coll. Peradeniya) numbers ran from *1* to *3860* up to the time of publication of his *Enumeratio Plantarum Zeylaniae*. More specmens were issued after the publication of the *Enumeratio*, the highest number in the ferns being *C.P. 4005*. An index to the *C.P.* numbers is included in the *Enumeratio* (pp. 451–468). In the text of the *Enumeratio* (pp. 378–397) the numbers of Gardner's ferns are given in parentheses after the *C.P.* numbers for the same species.

Specimens of *Diplazium* distributed by Gardner and Thwaites from Peradeniya frequently covered two and sometimes three species sent out under the same number. The following table summarizes the identifications of numbered Gardner and Thwaites specimens from Ceylon, where quoted, in the relevant works of Hooker, T. Moore and Thwaites, together with my own determinations of all the *Diplazium* specimens, so numbered, which I have examined in the herbaria cited.

Specimen	Hooker, Sp. Fil. iii (1860)	Moore, Index Fil. (1857–62)	Thwaites, Enum. Pl. Zeyl. (1864)	British Museum
1058 Gardner	*Asplenium dilatatum*	*Diplazium latifolium*	*Asplenium esculentum*	*Diplazium dilatatum* *Diplazium paradoxum*
1059 Gardner	*Asplenium dilatatum*	*Diplazium dilatatum* *Diplazium schkuhrii*		
1060 Gardner	*Asplenium dilatatum*	*Diplazium latifolium*	*Asplenium dilatatum*	*Diplazium paradoxum* *Diplazium polypodioides* var. *polypodioides*
1061 Gardner	*Asplenium polypodioides*	*Diplazium polypodioides* var. *majus*	*Asplenium polypodioides*	
1062 Gardner	*Asplenium polypodioides*	*Diplazium asperum*	*Asplenium polypodioides*	*Diplazium polypodioides* var. *polypodioides*
1063 Gardner			*Asplenium schkuhrii*	
1066 Gardner	*Asplenium polypodioides*	*Asplenium spectabile*	*Asplenium gymnogrammoides*	
1069 Gardner			*Asplenium gymnogrammoides*	
1245 Gardner			*Asplenium polypodioides* var. *β*	
1246 Gardner		? *Diplazium dilatatum*		
1247 Gardner			*Asplenium schkuhrii*	
1248 Gardner	*Asplenium dilatatum*	*Diplazium dilatatum* *Diplazium affine*		
1249 Gardner	*Asplenium zeylanicum*	*Diplazium zeylanicum*	*Asplenium zeylanicum*	
C.P. *1335* Thwaites	*Asplenium lanceum*	*Diplazium lanceum*	*Asplenium lanceum*	*Diplazium subsinuatum*
C.P. *1343* Thwaites	*Asplenium thwaitesii*	*Diplazium thwaitesii*	*Asplenium thwaitesii*	*Diplazium lasiopteris*
C.P. *1344* Thwaites	*Asplenium gymnogrammoides*	*Athyrium costale*	*Asplenium gymnogrammoides*	*Athyrium praetermissum* var. *praetermissum* *A. praetermissum* var. *erythrorachis*
C.P. *1347* Thwaites		*Asplenium assimile*	*Asplenium australe*	*Diplazium cognatum*
C.P. *1349* Thwaites	*Asplenium sylvaticum*	*Diplazium sylvaticum*	*Asplenium sylvaticum*	*Diplazium sylvaticum*
C.P. *1350* Thwaites		*Diplazium latifolium*	*Asplenium dilatatum*	*Diplazium paradoxum*
C.P. *1351* Thwaites	*Asplenium esculentum*	*Callipteris ambigua* *Diplazium dilatatum*		

Cambridge	Edinburgh	Kew	Peradeniya
Diplazium dilatatum *Diplazium esculentum*		*Diplazium dilatatum*	
	D. travancoricum, precociously fertile	*Diplazium sylvaticum*	
Diplazium paradoxum		*Diplazium paradoxum*	*Diplazium paradoxum*
Diplazium polypodioides var. *polypodioides*	*Diplazium polypodioides* var. *polypodioides*	*Diplazium polypodioides* var. *polypodioides*	*Diplazium polypodioides* var. *polypodioides*
Diplazium polypodioides var. *polypodioides*	*Diplazium polypodioides* var. *polypodioides*	*Diplazium polypodioides* var. *polypodioides*	*Diplazium polypodioides* var. *polypodioides*
Diplazium beddomei		*Diplazium beddomei*	*Diplazium beddomei*
Diplazium muricatum		*Diplazium muricatum*	
		Athyrium praetermissum var. *praetermissum*	*Diplazium muricatum*
Diplazium decurrens			*Diplazium decurrens*
Diplazium decurrens		*Diplazium decurrens*	
Diplazium beddomei		*Diplazium beddomei*	*Diplazium beddomei*
Diplazium dilatatum		*Diplazium dilatatum*	
		Diplazium zeylanicum	*Diplazium zeylanicum*
	Diplazium subsinuatum	*Diplazium subsinuatum*	*Diplazium subsinuatum*
	Diplazium lasiopteris	*Diplazium lasiopteris*	*Diplazium lasiopteris*
	Athyrium praetermissum var. *praetermissum* *A. praetermissum* var. *erythrorachis* *Diplazium muricatum*	*Athyrium praetermissum* var. *praetermissum* *A. praetermissum* var. *tripinnatum*	*Athyrium praetermissum* var. *praetermissum* *A. praetermissum* var. *erythrorachis* *A. praetermissum* var. *tripinnatum* *Diplazium muricatum*
	Diplazium cognatum	*Diplazium cognatum*	*Diplazium cognatum*
	Diplazium sylvaticum	*Diplazium sylvaticum*	*Diplazium sylvaticum*
	Diplazium dilatatum *Diplazium paradoxum*	*Diplazium dilatatum*	*Diplazium dilatatum* *Diplazium paradoxum* *Diplazium procumbens*
		Diplazium paradoxum	

Specimen	Hooker, Sp. Fil. iii (1860)	Moore, Index Fil. (1857–62)	Thwaites, Enum. Pl. Zeyl. (1864)	British Museum
C.P. *1352* Thwaites	*Asplenium polypodioides*	*Diplazium polypodioides* var. *majus*	*Asplenium polypodioides*	*Diplazium polypodioides* var. *polypodioides*
C.P. *1353* Thwaites	*Asplenium polypodioides*	*Diplazium asperum*	*Asplenium polypodioides*	*Diplazium polypodioides* var. *polypodioides*
C.P. *3098* Thwaites		*Diplazium dilatatum*	*Asplenium polypodioides*	*Diplazium procumbens*
C.P. *3100* Thwaites			*Asplenium schkuhrii*	*Diplazium beddomei*
C.P. *3101* Thwaites			*Asplenium zeylanicum*	*Diplazium zeylanicum*
C.P. *3270* Thwaites	*Asplenium esculentum*	*Callipteris ambigua*	*Asplenium esculentum*	
C.P. *3332* Thwaites	*Asplenium polypodioides*	*Diplazium dilatatum* var. *minus*	*Asplenium polypodioides* var. β	*Diplazium decurrens*
C.P. *3892* Thwaites				
C.P. *3951* Thwaites				
C.P. *3990* Thwaites				

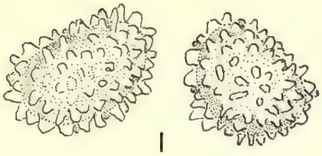
Cambridge	Edinburgh	Kew	Peradeniya
	Diplazium polypodioides var. *polypodioides*	*Diplazium polypodioides* var. *polypodioides* *D. polypodioides* var. *brachylobum*	*Diplazium polypodioides* var. *polypodioides* *Diplazium procumbens*
	Diplazium polypodioides var. *polypodioides* *Diplazium dilatatum* *Diplazium procumbens*	*Diplazium polypodioides* var. *polypodioides*	*Diplazium polypodioides* var. *polypodioides*
	Diplazium polypodioides var. *polypodioides*		
	Diplazium beddomei	*Diplazium beddomei* *Diplazium procumbens*	*Diplazium beddomei*
	Diplazium zeylanicum	*Diplazium zeylanicum*	*Diplazium zeylanicum*
	Diplazium esculentum	*Diplazium esculentum*	*Diplazium esculentum*
	Diplazium decurrens	*Diplazium decurrens*	*Diplazium decurrens*
Diplazium sylvaticum, dentate variation		*Diplazium sylvaticum*, dentate variation	*Diplazium sylvaticum*, dentate variation
		Diplazium polyrhizon	*Diplazium polyrhizon* *Diplazium beddomei*
		Diplazium paradoxum	*Diplazium paradoxum*

BRITISH MUSEUM 23 SEP 1962 NATURAL HISTORY

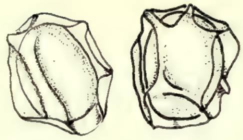
PLATE 30

Spores (×380)

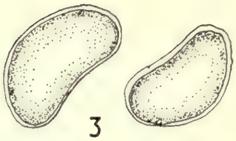
FIGS. 1–15. Fig. 1, *Dryoathyrium boryanum* (Willd.) Ching; Fig. 2, *Athyrium hohenackeranum* (Kunze) T. Moore; Fig. 3, *A. nigripes* (Bl.) T. Moore; Fig. 4, *A. solenopteris* (Kunze) T. Moore; Fig. 5, *A. macrocarpon* (Bl.) Bedd.; Fig. 6, *A. anisopterum* Christ; Fig. 7, *A. praetermissum* Sledge; Fig. 8, *Diplazium subsinuatum* (Hook. & Grev.) Tagawa; Fig. 9. *D. zeylanicum* (Hook.) T. Moore; Fig. 10, *D. lasiopteris* Kunze; Fig. 11, *D. polyrhizon* (Bak.) Sledge; Fig. 12, *D. beddomei* C. Chr.; Fig. 13, *D. decurrens* Bedd.; Fig. 14, *D. sylvaticum* (Bory) Sw.; Fig. 15, *D. dilatatum* Bl.



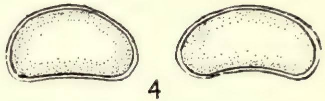
1



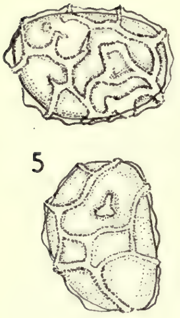
2



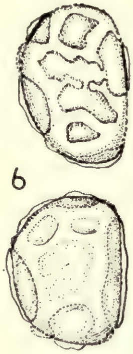
3



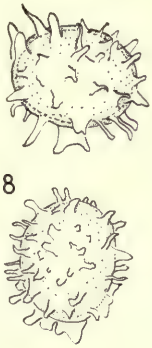
4



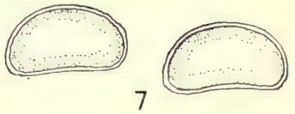
5



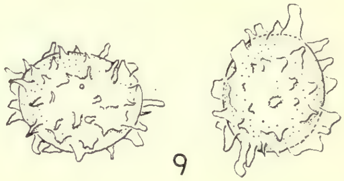
6



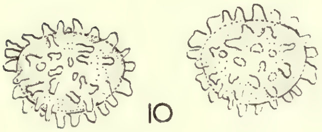
8



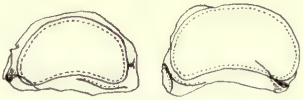
7



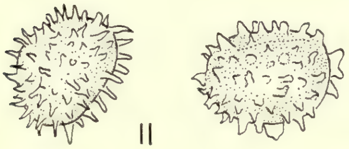
9



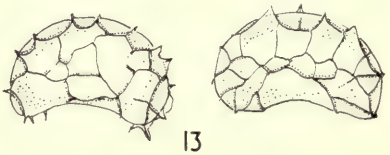
10



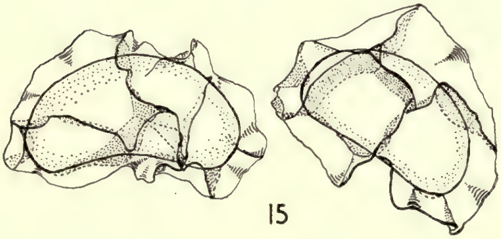
12



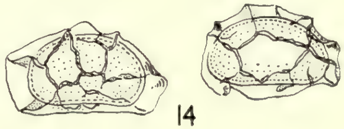
11



13



15

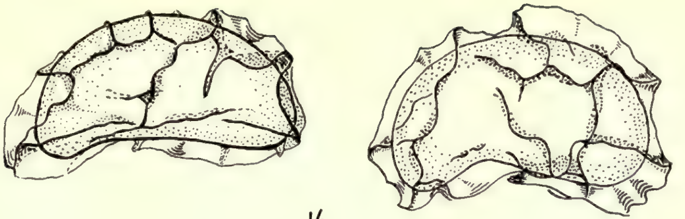


14

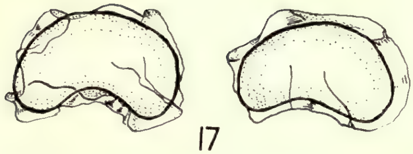
PLATE 31

Spores (×380)

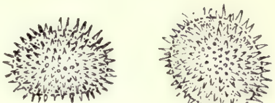
FIGS. 16–23. Fig. 16, *Diplazium travancoricum* Bedd. ; Fig. 17, *D. polypodioides* Bl. ; Fig. 18, *D. cognatum* (Hieron.) Sledge ; Fig. 19, *D. esculentum* (Retz.) Sw. ; Fig. 20, *D. paradoxum* Fée ; Fig. 21, *D. muricatum* (Mett.) Alderw. van Rosenb. ; Fig. 22, *D. procumbens* Holtt. ; Fig. 23, *Diplaziopsis javanica* (Bl.) C. Chr.



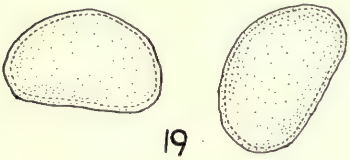
16



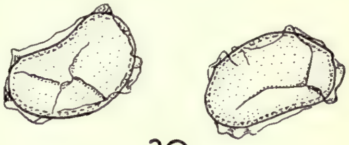
17



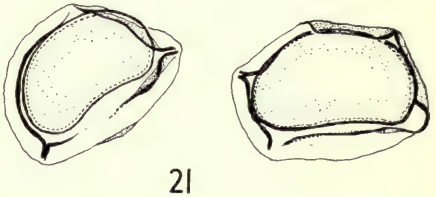
18



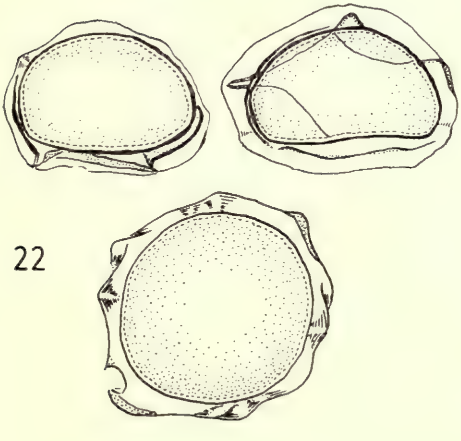
19



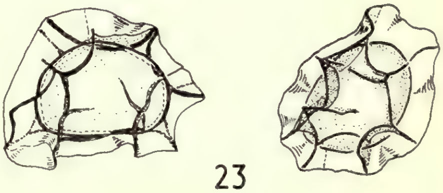
20



21



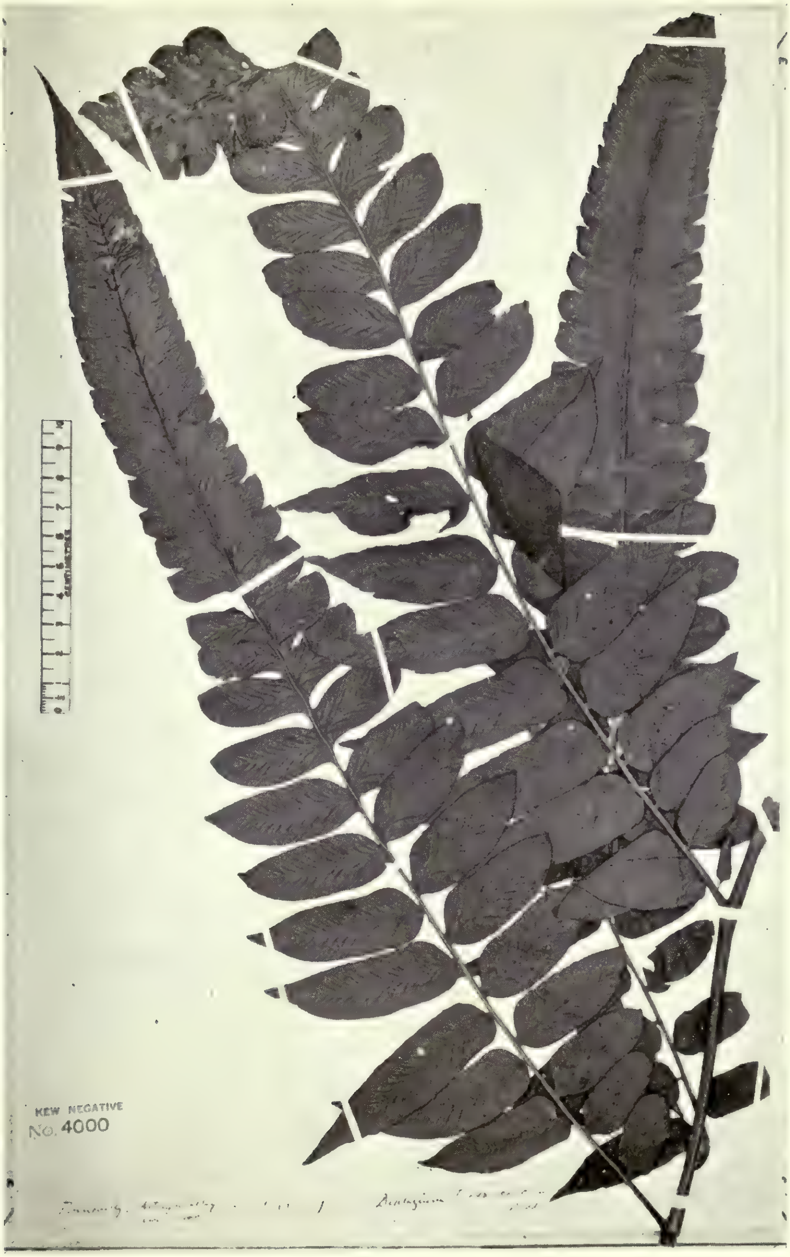
22



23

PLATE 32

Type of *Diplazium travancoricum* Bedd.


KEW NEGATIVE
No. 4000

B. M. A. C.

THE GENUS *EPILOBIUM* IN THE HIMALAYAN REGION

P. H. RAVEN

BRITISH MUSEUM NATURAL HISTORY

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 12
LONDON: 1962

THE GENUS *EPILOBIUM* IN THE HIMALAYAN REGION

BY

P. H. RAVEN xvi.
(Rancho Santa Ana Botanic Garden)

BRITISH MUSEUM
NATURAL HISTORY

Pp. 325–382 ; 13 *Text-figures* ; *Plates* 33–39

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
BOTANY Vol. 2 No. 12
LONDON : 1962

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical Series.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 12 of the Botany series.

© Trustees of the British Museum, 1962

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued November 1962 *Price Thirty Shillings*

THE GENUS *EPILOBIUM* IN THE HIMALAYAN REGION

By P. H. RAVEN

REPRESENTATIVES of the genus *Epilobium* (*Onagraceae*) occur on all continents, but most of the species are restricted to relatively high altitudes or latitudes. One concentration of its species is in the Himalayan region, from which 37 species are recognized in the following treatment. The main area concerned for the purposes of this paper extends from the western borders of West Pakistan in Chitral and the Kurram Valley at approximately 71° E. in the west to the region of the Tsangpo Gorges at about 96° E. in the east. Relatively few species of *Epilobium* occur south of the main Himalayan Range, but I have included here the few related species occurring further to the south in Assam, the Naga Hills, Manipur and Burma. None of the species of this genus ranges far away from the main crest of the Himalayan Range in West Pakistan or India, and none occurs in the mountains of southern India or in Ceylon. The present account is based on specimens of *Epilobium* in the herbaria of the following institutions: Department of Botany, British Museum (Natural History) (BM); Royal Botanic Garden, Edinburgh (E); Conservatoire Botanique, Genève (G); Royal Botanic Gardens, Kew (K); Herbarium Haussknecht, Jena (JE); Academy of Sciences of the U.S.S.R., Leningrad (LE); Linnean Society of London (LINN); and Naturhistorisches Museum, Wien (W). With the exception of a few which are unsatisfactory or poorly localized, all of the specimens examined are cited here, and the institutions where they are deposited are indicated by the abbreviations shown in parentheses above. The paper also includes a key to the species of *Epilobium* from the area outlined above, and full synonymy for all species except the five discussed below which occur far beyond the limits of this area. For these five, I have given only the most important synonyms and those pertinent to the Himalaya. Thirteen new species, one new subspecies and two new formae are described from this area; 19 previously recognized species are reduced to synonymy and four relegated to the rank of subspecies; and one that has been previously regarded as a synonym is elevated to the rank of subspecies. In addition, lectotypes have been chosen for many previously described species, particularly those of Haussknecht.

Five of the species of *Epilobium* that occur in the Himalaya also range widely beyond its limits, and four of them—*E. angustifolium*, *E. hirsutum*, *E. latifolium* and *E. palustre*—were named by Linnaeus in the first edition of his *Species Plantarum* (1753). The fifth, *E. parviflorum*, was published 18 years later from European material by J. C. D. Schreber in his *Spicilegium Florae Lipsicae* (1771). The first publication to describe a species of *Epilobium* from Himalayan material is David Don's *Prodromus Florae Nepalensis* (1825). This pioneer work was prepared by Don while he was employed as the librarian of A. B. Lambert. The two Nepalese collections in Lambert's extensive herbarium each provided a species of *Epilobium* described by Don. Thus *E. brevifolium* was based on a specimen collected by Francis Buchanan (later Hamilton) near Katmandu in 1802, and *E. cylindricum* on material obtained in the same vicinity by Nathaniel Wallich in August 1821. Wallich's *A numerical List of dried specimens of plants in the East India Company's Museum* (1829–49), of which the portion dealing with *Onagraceae* (part of p. 216) appeared in 1832, listed a number of names that were applied to Himalayan specimens of *Epilobium.* Wallich was the first director of the Calcutta Botanic Garden, and evidently a man of great energy. His extensive catalogue, listing plants drawn from many parts of the Himalaya by several collectors, including Wallich himself, contains the first notice of such common Himalayan species of *Epilobium* as *E. amplectens* (now called *E. laxum*) and *E. laetum* (herein treated as *E. amurense* subsp. *laetum*). Although Wallich's names were not validly published for species until 1884, they were generally accepted and used in the intervening 52 years because the wide distribution of his numbered specimens fixed their application. John Forbes Royle, a surgeon in the service of the East India Company, was stationed at Saharanpur, Uttar Pradesh, in 1823–24. From this centre Royle and his collectors obtained the specimens that formed the basis for his *Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains, and of the Flora of Cashmere* (1833–40), in which eight Himalayan species of *Epilobium* are listed by name (p. 211) ; five of the names are *nomina nuda*[1], but one new species (*E. laxum*, t. 43 fig. 2) is described and figured. In 1844 Joseph Decaisne, author of " Plantae rariores, quas in India orientali collegit Victor Jacquemont ", which constituted part of the fourth volume of *Voyage dans l'Inde, par Victor Jacquemont, pendent les années 1828 à 1832*, published and figured *E. speciosum* (pp. 57–58, t. 69) ; this name has often been regarded as a synonym of *E. latifolium.*

As is the case in most groups of Himalayan plants with a montane distribution, the first extensive collections of the genus *Epilobium* from this area were made by Thomas Thomson in 1847–48 in Kashmir, Ladakh and adjacent portions of the Western Himalaya and by Sir Joseph Hooker in 1848–49 in Sikkim and easternmost Nepal. In 1850 these two collected together in and around the Khasi Hills and elsewhere in Assam. Earlier a few others, such as Lady Dalhousie, had contributed smaller collections from the western portions of the Range. Hooker and Thomson's collections provided much important material for Hooker's classical *Flora of British India* (1872–97). The portion of this work dealing with *Onagraceae* (ii : 582–590) was written by C. B. Clarke and appeared in May 1879. Owing to Clarke's very broad specific concepts in *Epilobium,* however, and his inability to distinguish many of the Himalayan species from their European relatives, his treatment constitutes only a minor step forward in our understanding of the genus. This is particularly true in view of the fact that Carl Haussknecht, the foremost student of the genus *Epilobium,* published his fundamental *Monographie der Gattung Epilobium* at Jena in 1884. Haussknecht had had access to the same material as Clarke at Kew and published all of the same new species in February 1879, i.e. some three months earlier than Clarke, in the first instalment of an interrupted series of articles in *Oesterreichische botanische Zeitschrift* (xxix : 51–59, 89–91, 118–120, 148–151). Despite the fact that Haussknecht cited all of the synonymy clearly in his *Monographie*, many of Clarke's names have been widely used up to the present time owing to the general importance and wide usefulness of the *Flora of British India* as an authoritative source for the taxonomy of the plants of this region.

---

[1] These are *E. laeve* Royle, *E. himalense* Royle, *E. herbertianum* Royle, *E. decussatum* Royle, together with *E. sericeum* Benth. ex Wall.

The *Monographie der Gattung Epilobium*, referred to above, initiated a new era in studies of the genus because of Haussknecht's wide acquaintance with the group throughout its range and his keen taxonomic sense. Consequently he was able to utilize many characters that had largely been ignored by earlier authors and to apply correctly the specific epithets that they had proposed, thus ensuring a stable nomenclature for the group. The amount of material available to Haussknecht from the Himalaya was not extensive ; moreover, there was very little known at the time about the closely related floristic region of western China. Nevertheless, Haussknecht had sufficient material to describe no less than 20 species of *Epilobium* from the Himalaya, 17 of which are recognized as valid species or, in a few cases, subspecies in the present paper. Special mention should be made of the formae listed by Haussknecht in his *Monographie*. As it is obvious that these were not meant to be mutually exclusive, and as they are uniformly given epithets in the feminine, not neuter, gender, I do not believe that Haussknecht considered them to be on the same level as his formal taxonomic units (species and varietates), and consequently I have not treated them as such here.

Since the appearance of Haussknecht's *Monographie* very little taxonomic work has been done on the genus *Epilobium* in the Himalayan region. Only one author, Hector Léveillé, has described any new species from the area during the past 78 years. Of his three proposed species from the Himalaya, two are here united with earlier-described species, and one cannot be identified with certainty in the absence of authentic material. One other species that Léveillé described from western China, however, is here regarded as a valid subspecies of *E. wallichianum*. The uneven quality of Léveillé's taxonomic studies has been commented upon briefly by Stearn (in Journ. R. Hort. Soc. Lond. lxiii : 196 (1938)) ; it may also be mentioned, for example, that the type of *E. tonkinense* H. Lév. (from near Quang Yen, North Vietnam, 29 Nov. 1885, *Balansa 1398* (G)) is *Stylidium tenellum* Sw. (*Stylidiaceae*). In summary, therefore, despite the accumulation of hundreds of new gatherings, not a single new species here regarded as valid has been published from the entire Himalayan region since 1884.

Thus it is not surprising that the taxonomy of *Epilobium* in this region has become more and more confused. In 1884, large areas of the Eastern Himalaya were unexplored botanically and indeed so remained until the past three decades. Nepal, for example, was not extensively explored botanically until after the Second World War. Particularly significant collections have resulted from British expeditions to Bhutan and south-eastern Tibet between 1933 and 1949 and to Nepal between 1949 and 1956, and also material from the numerous Himalayan and Burmese expeditions of the late F. Kingdon-Ward extending from 1924 to 1956. This additional material of *Epilobium* has clearly revealed that the Himalaya, particularly in its eastern portions, is much richer in species of *Epilobium* than has heretofore been suspected. In addition to the 16 new taxa described in this paper, there are certainly undescribed species represented by fragmentary specimens in the material I have examined ; but these are best left unnamed until more complete material becomes available, since at present it would be impossible to place them with confidence in the classification of the genus. Moreover, more complete specimens of many Himalayan species of *Epilobium*, especially if correlated with field and garden studies, will greatly help to clarify the taxonomy of the 37 species included here.

IMPORTANT TAXONOMIC CHARACTERS IN *EPILOBIUM*

Haussknecht (Monogr. Epil. : 11–19) has provided an extensive review of morphological variability in the genus, but it may not be out of place to comment briefly upon this here. Particularly significant in this genus are differences in the mode of innovation. Some species have above-ground leafy or filiform stolons, whereas others are vegetatively propagated from underground buds. The shoots arising from these may either be erect and leafy, or spreading laterally and pale (soboles), or condensed and fleshy overwintering organs (turions). Irrespective of the mode or propagation, underground stems may be more or less vertical and stout or rhizomatous and spreading. In the former case, as is common in many Himalayan species, the stems are often clothed for varying lengths with tufts of brown coriaceous scales of diverse shape. With such extensive and taxonomically significant variation in the underground parts of plants of this genus, it should be evident that it is very important that specimens be dug and prepared carefully so as to preserve these features.

I have in the following treatment paid considerable attention to the pubescence of the stem. In some species of *Epilobium* the stems are pubescent all round, whereas in others they are pubescent, at least below, only along definite more or less elevated lines that are decurrent from the margins of the petioles. In both *E. brevifolium* and *E. royleanum*, however, species in which the stems are normally pubescent all round, occasional plants occur with distinct pubescent lines while the remainder of the stem is glabrous. In addition, species of *Epilobium* differ greatly in stature, type of pubescence, degree of glaucescence and crowding of the leaves. Leaf shape and margin likewise provide useful characters.

In some species of *Epilobium*, the inflorescence is conspicuously drooping before anthesis, whereas in others it is erect ; in either case the buds may be more or less appressed to the rhachis or they may be individually pendulous and deflexed from it. These characters are of considerable taxonomic significance but unfortunately cannot always be determined easily from herbarium specimens. They will doubtless become more important as they are studied in living material. Flower length, which is an index of flower size, is measured from the base of the hypanthium to the tips of the petals. Petal colour is also variable and, again, probably more important than can be determined from herbarium specimens with certainty. Characters of the stigma are important in *Epilobium*, as was first clearly demonstrated by Haussknecht, most of the species having an entire clavate or capitate stigma, the remainder a more or less deeply divided four-lobed or four-partite one. In many of the latter species only the inner surfaces of the stigmatic lobes are receptive and, since the stigma does not open until the flowers have opened, this constitutes an obvious outcrossing mechanism. In all of the species with an entire stigma and some of those with a divided stigma, on the other hand, the anthers shed their pollen on the receptive stigma in bud, a mechanism that insures a high degree of inbreeding.

In fruiting specimens of this genus, the length of the capsules and of their pedicels, the pubescence of the capsules and proportions of the subtending bracts are useful characters. Seed size and shape are also important, although I find it impossible to divide the species with entire stigmas sharply into two groups, *Obovoideae* and *Attenuatae*, on the basis of seed shape as was done by Haussknecht (Monogr. Epil.: 21). The presence and nature of papillae on the mature seed coat are likewise useful characters, but clearly dependent upon the magnification at which the observations are made. For this paper, this may be taken as ×20. Finally, in a few species of *Epilobium* the coma of the seeds is not white but brownish or reddish. The great majority of collections of this genus from the Himalaya lack mature seeds, and this has been a handicap in the preparation of the present treatment. Additional fruiting specimens, especially ones in which the underground parts are adequately represented, are much to be desired from all parts of the Himalaya.

DELIMITATION AND SUBDIVISION OF *EPILOBIUM*

A number of botanists, particularly in northern Europe, have separated generically from *Epilobium* that group of species which is herein treated as Section *Chamaenerion*. Although this is not the place to comment at length on the generic classification of the tribe *Epilobieae*, a few comments may be appropriate. Whereas the majority of species of *Epilobium* have actinomorphic flowers, opposite lower leaves, a well-developed hypanthium, emarginate petals and pollen-grains falling united into tetrads, *Chamaenerion* comprises species with slightly zygomorphic flowers, entirely alternate leaves, a very short hypanthium, entire petals and pollen-grains falling individually. None of these characters is, however, peculiar to Sect. *Chamaenerion*, although there is no species of *Epilobium*, other than in this section, in which they are all combined. It cannot therefore be disputed that Sect. *Chamaenerion* constitutes a distinct assemblage of species within the genus *Epilobium*, but the question is whether it is useful to accord it generic status. In northern Europe the choice is relatively simple, since only one section of the genus *Epilobium*, i.e. Sect. *Epilobium*, is represented in addition to *Chamaenerion*. Taking the genus as a whole, however, there are seen to be other groups of *Epilobium* species which are more distantly related to Sect. *Epilobium* than is Sect. *Chamaenerion*. In my opinion, nothing is to be gained by recognizing a number of small genera peripheral to *Epilobium*, as this would remove fewer than 15 species from a genus broadly consisting of more than 200. Since all of these groups have clearly had a common origin, I prefer to emphasize this by keeping them together as one distinct unit. The facts of this case are relatively clear, and the decision one of personal judgment; but if we are to have a relatively stable system of names, it is preferable to refrain from revising generic limits without a comprehensive study of all species concerned.

I will further comment here only on the possibility of infra-sectional classification of the species of *Epilobium* of the Himalaya, which I consider to fall into the two sections *Epilobium* (*Lysimachion* Tausch), with 34 species, and *Chamaenerion* Tausch, with only three. Haussknecht (Monogr. Epil.: 21–23) divided Sect. *Epilobium* (*Lysimachion*) into a number of minor groups, but in my opinion this may be more confusing than helpful, especially in view of the evident close relationship and frequent hybridization between even morphologically remote species. I would certainly not attempt to classify further the Himalayan species of this section.

DISTRIBUTION OF *EPILOBIUM* IN THE HIMALAYAN REGION

Most of the species of *Epilobium* in the Himalaya are mountain plants, and few occur below 1,000 m. (3,300 ft.). Above 2,750 m. (9,000 ft.) plants of this genus are widely distributed in open woodland and subalpine meadows, particularly where moist. Many grow in alpine meadows and on moist scree slopes, and some also occur in moist *Rhododendron* scrub. Judging from the rather numerous mixed collections of species of *Epilobium* that have been obtained in the Himalaya, it appears likely that ecological differentiation does not play a major role in keeping these species separate. Nevertheless, there are certainly interspecific ecological differences which will become more clearly understood as our knowledge of the species concerned increases.

In his treatment of " *Allium* and *Milula* in the central and eastern Himalaya " (Bull. Brit. Mus. (Nat. Hist.), Bot. ii: 159–191 (1960)), William T. Stearn has provided a classification of the types of distribution of montane and alpine Himalayan species which provides a useful basis for our consideration of the ranges of *Epilobium* species in this area. With the exception of *E. kermodei*, which is endemic to Burma (fig. 4), all of the species included in the present treatment fall into Stearn's divisions, although several of them have wider ranges than any of the species he considered.

Five Himalayan species of *Epilobium* range very widely outside the limits of the area being considered here. *E. angustifolium* (fig. 1), for example, is a circumboreal species that occurs widely throughout the temperate portions of the Northern Hemisphere. It is common in the western Himalaya as far east as Kumaun and in the eastern Himalaya as far west as Bhutan, but is unexpectedly rare in Nepal and Sikkim, with only a few collections available from these countries. It is widely distributed across Asia north of the Himalaya and may have independently entered the Range at both of its extremities. *E. latifolium* (fig. 2) is also circumboreal in range and has a Himalayan distribution analogous to that of *E. angustifolium*, being relatively common from easternmost Afghanistan to western Nepal and reappearing locally in south-eastern Tibet and the mountains of western China. In contrast to those of *E. angustifolium*, the Himalayan stations of *E. latifolium* are disjunct from its more or less continuous range further north in Asia. *E. hirsutum* (fig. 3) and *E. parviflorum* (fig. 4) both range widely across Eurasia and are found in the Western

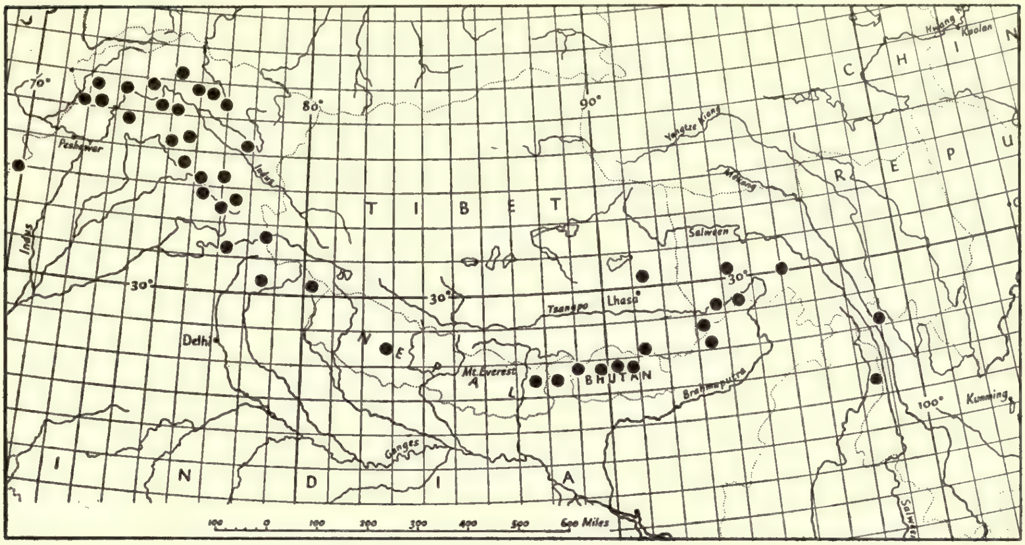

70°
80°
90°
100°
30°
Peshawar
Indus
TIBET
CHINA REPU
Yangtze Kiang
Mekong
Salween
Lhasa
Tsangpo
Delhi
NEPAL
Mt. Everest
BHUTAN
Brahmaputra
Ganges
INDIA
Kunming
Hwang Ho
Koolan
100 0 100 200 300 400 500 600 Miles

FIG. 1. Distribution of *Epilobium angustifolium* in the Himalayan region.

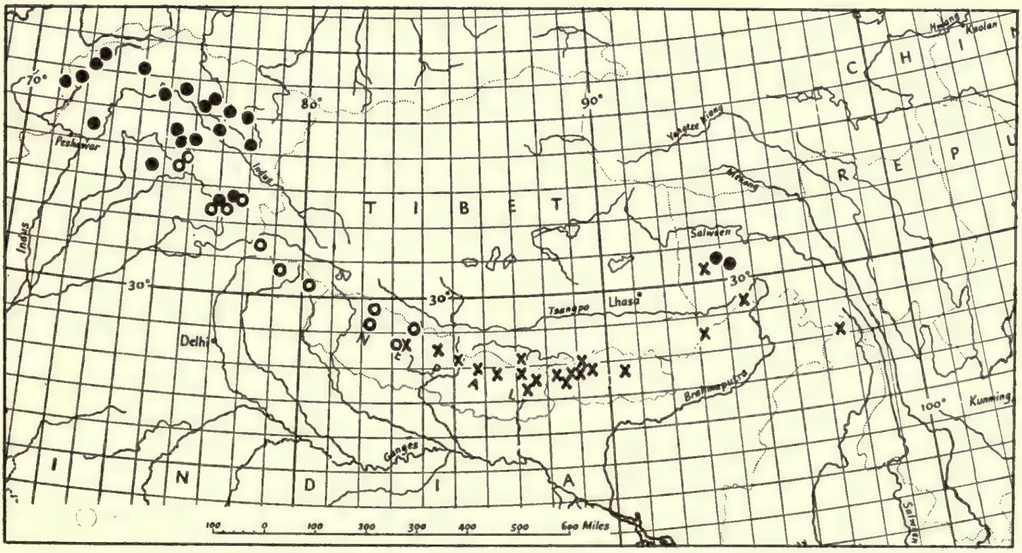

70°
80°
90°
100°
30°
Peshawar
Indus
TIBET
CHINA REPU
Yangtze Kiang
Mekong
Salween
Lhasa
Tsangpo
Delhi
NEPAL
Brahmaputra
Ganges
INDIA
Kunming
Hwang Ho
Koolan
100 0 100 200 300 400 500 600 Miles

FIG. 2. Distribution of: ● *Epilobium latifolium* subsp. *latifolium* (in the Himalayan region); ○ *E. latifolium* subsp. *speciosum*; X *E. conspersum* (in the Himalayan region).

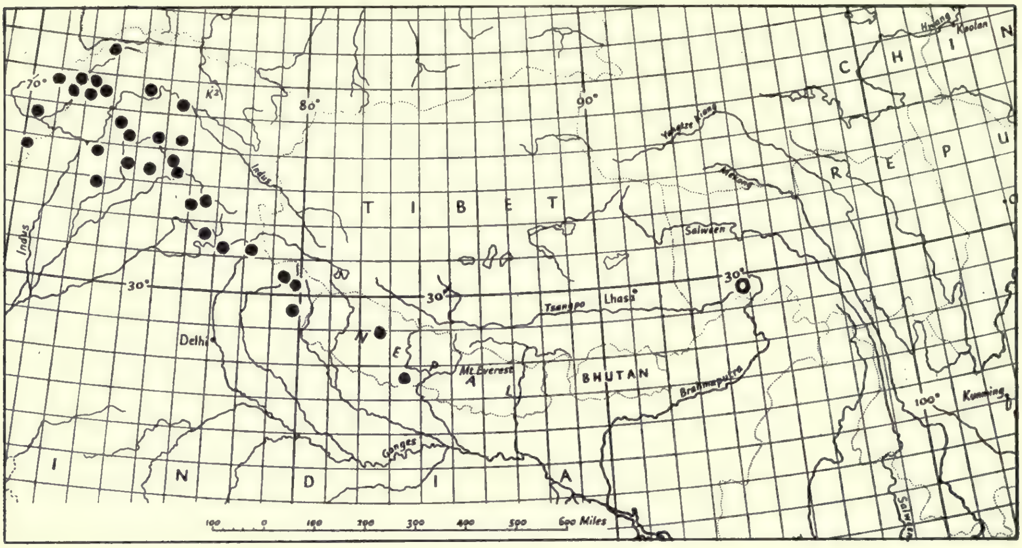

70°
80°
90°
100°
30°
K²
Indus
TIBET
CHINESE REPUBLIC
Hwang Ho
Koolan
Yangtze Kiang
Mekong
Salween
Tsangpo
Lhasa
Delhi
NEPAL
Mt. Everest
BHUTAN
Brahmaputra
Ganges
INDIA
Kunming
100 0 100 200 300 400 500 600 Miles

FIG. 3. Distribution of : ● *Epilobium hirsutum* (in the Himalayan region) ; ○ *E. soboliferum*.

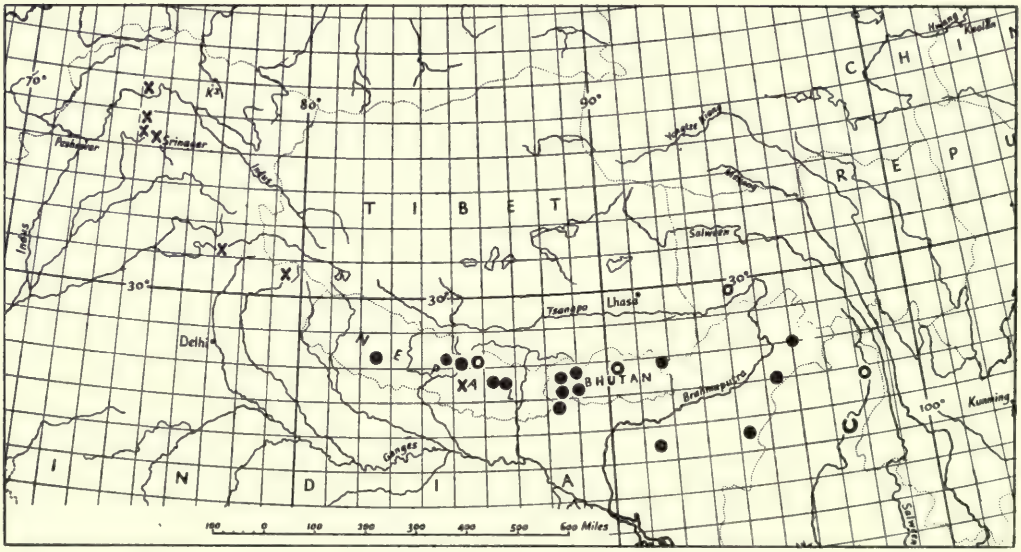

70°
80°
90°
100°
30°
K²
Peshawar
Srinagar
Indus
TIBET
CHINESE REPUBLIC
Hwang Ho
Koolan
Yangtze Kiang
Mekong
Salween
Tsangpo
Lhasa
Delhi
NEPAL
BHUTAN
Brahmaputra
Ganges
INDIA
Kunming
100 0 100 200 300 400 500 600 Miles

FIG. 4. Distribution of : ● *Epilobium wallichianum* subsp. *wallichianum* (in the; Himalayan region) ; ○ *E. wallichianum* subsp. *souliei* (in the Himalayan region) X *E. parviflorum* (in the Himalayan region) ; U *E. kermodei*.

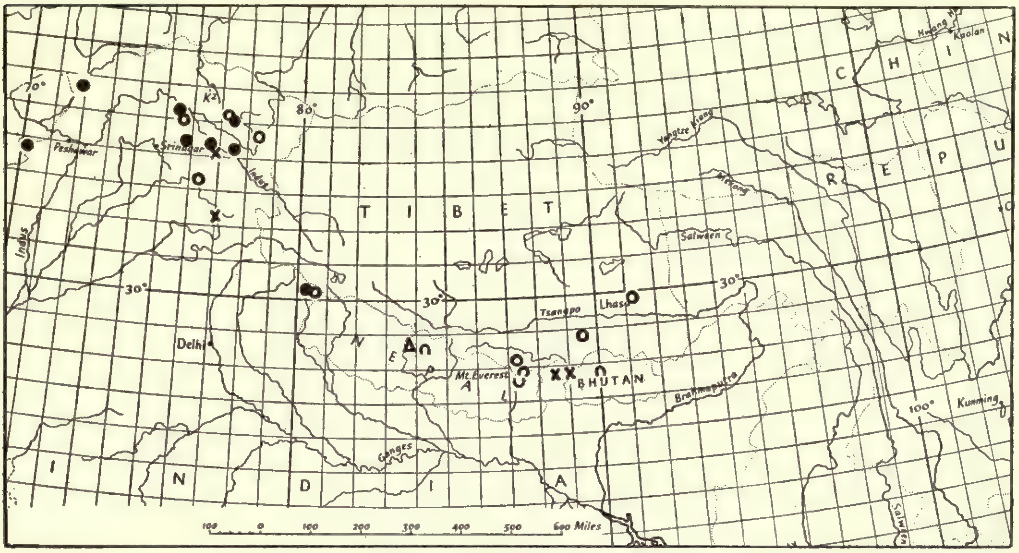

70°
K2
80°
90°
Peshawar
Srinagar
Indus
T I B E T
C H I N
R E P U
Hwang Ho
Koolan
Yangtze Kiang
Mekong
Salween
30°
Tsangpo
Lhasa
Delhi
N E P A L
Mt. Everest
BHUTAN
Brahmaputra
100°
Kunming
Ganges
I N D I A
100 0 100 200 300 400 500 600 Miles

FIG. 5. Distribution of: ● *Epilobium minutiflorum* (in the Himalayan region); ○ *E. palustre* (in the Himalayan region); X *E. pseudobscurum*; U *E. squamosum*; ∩ *E. trilectorum*; △ *E. staintonii*.

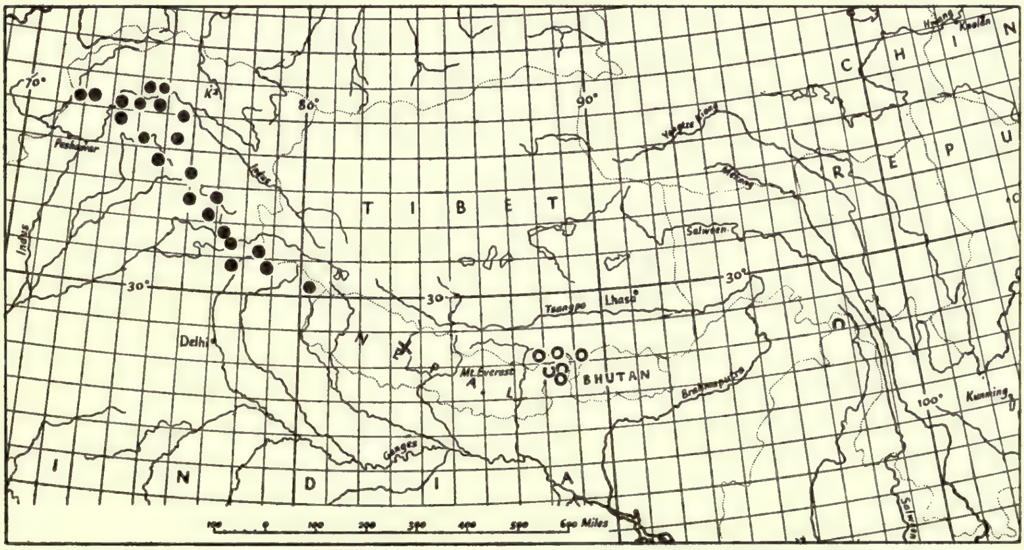

70°
K2
80°
90°
Peshawar
Indus
T I B E T
C H I N
R E P U
Hwang Ho
Koolan
Yangtze Kiang
Mekong
Salween
30°
Tsangpo
Lhasa
Delhi
N E P A L
Mt. Everest
BHUTAN
Brahmaputra
100°
Kunming
Ganges
I N D I A
100 0 100 200 300 400 500 600 Miles

FIG. 6. Distribution of: ● *Epilobium laxum* (in the Himalayan region); ○ *E. gouldii*; X *E. brevisquamatum*; U *E. trichophyllum*; ∩ *E. clarkeanum*.

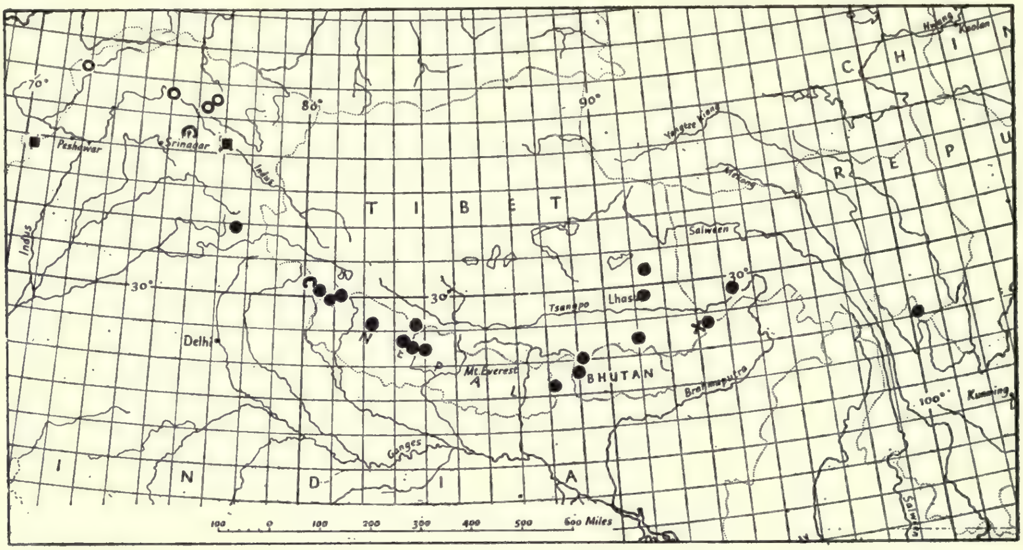

70°
80°
90°
100°
30°
Peshawar
Srinagar
Indus
TIBET
Delhi
NEPAL
Mt. Everest
BHUTAN
Lhasa
Tsangpo
Salween
Mekong
Yangtze Kiang
Brahmaputra
Ganges
INDIA
C H I
R E P
Kunming
Salween
100 0 100 200 300 400 500 600 Miles

FIG. 7. Distribution of : ● *Epilobium williamsii* ; ○ *E. chitralense* ; X *E. kingdonii* ; ∩ *E. wattianum* ; ■ *E. aitchisonii.*

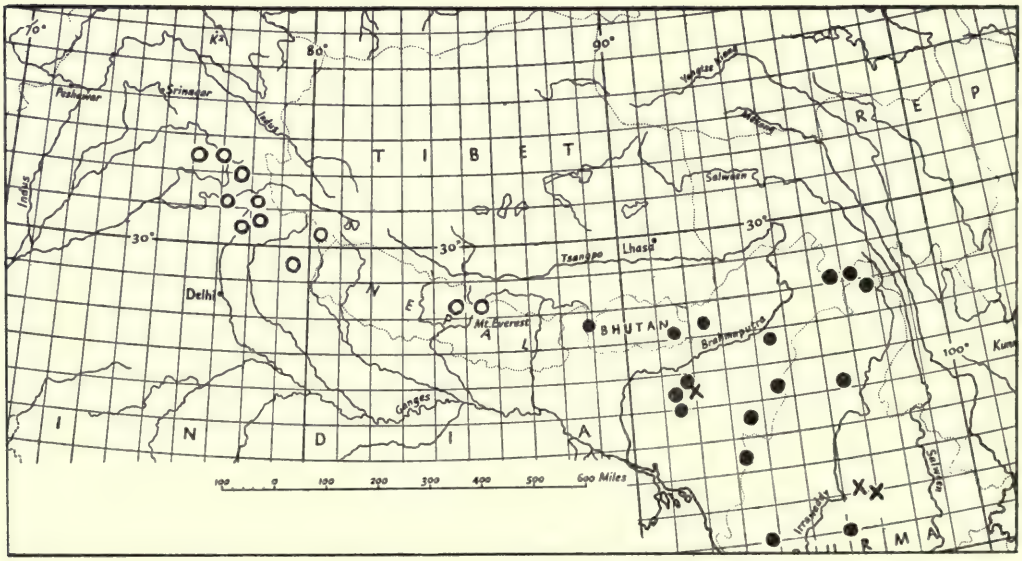

70°
K2
80°
90°
100°
30°
Peshawar
Srinagar
Indus
TIBET
Delhi
NEPAL
Mt. Everest
BHUTAN
Lhasa
Tsangpo
Salween
Mekong
Yangtze Kiang
Brahmaputra
Ganges
INDIA
R E P
Irrawaddy
Salween
R M A
100 0 100 200 300 400 500 600 Miles

FIG. 8. Distribution of : ● *Epilobium brevifolium* subsp. *trichoneurum* (in the Himalayan region) ; ○ *E. brevifolium* subsp. *brevifolium* ; X *E. brevifolium* subsp. *pannosum* (in the Himalayan region).

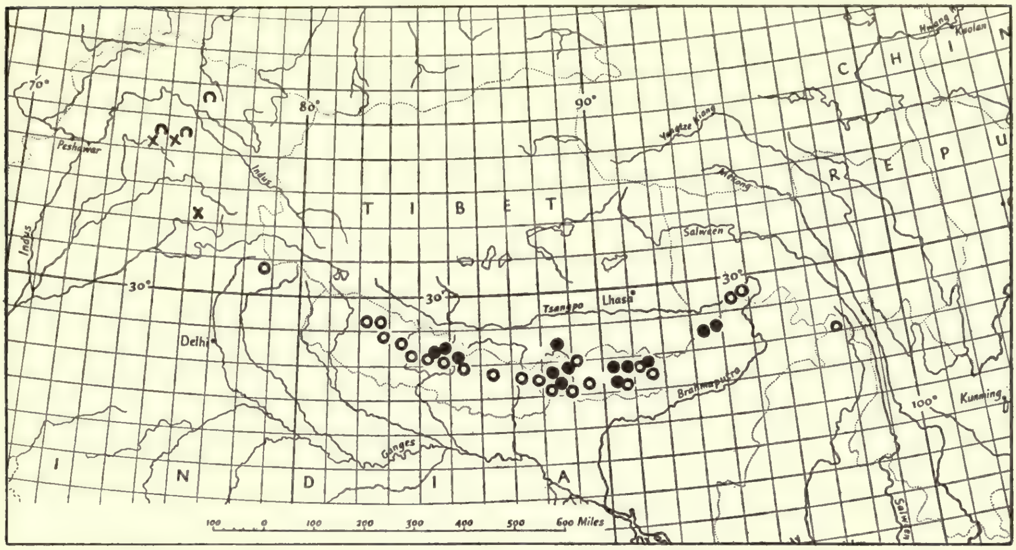

70°
80°
90°
Peshawar
Indus
T I B E T
Yangtze Kiang
Mekong
Salween
C H I N
R E P U
30°
Delhi
Tsangpo
Lhasa
Brahmaputra
100°
Kunming
Ganges
I N D I A
100 0 100 200 300 400 500 600 Miles

FIG. 9. Distribution of : ● *Epilobium sikkimense* subsp. *sikkimense* (in the Himalayan region) ; ○ *E. sikkimense* subsp. *ludlowianum* (in the Himalayan region) ; X *E. rhynchospermum* ; ∩ *E. glaciale.*

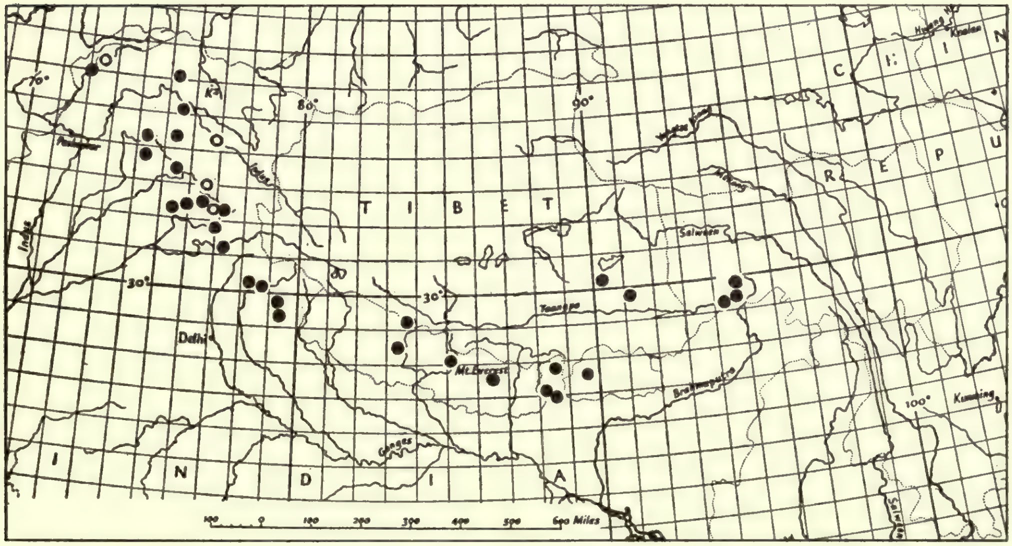

70°
80°
90°
Indus
T I B E T
C H I N
R E P U
Salween
30°
Delhi
Tsangpo
Mt Everest
Brahmaputra
100°
Kunming
Ganges
I N D I A
100 0 100 200 300 400 500 600 Miles

FIG. 10. Distribution of : ● *Epilobium cylindricum* (in the Himalayan region) ; ○ *E. leiophyllum.*

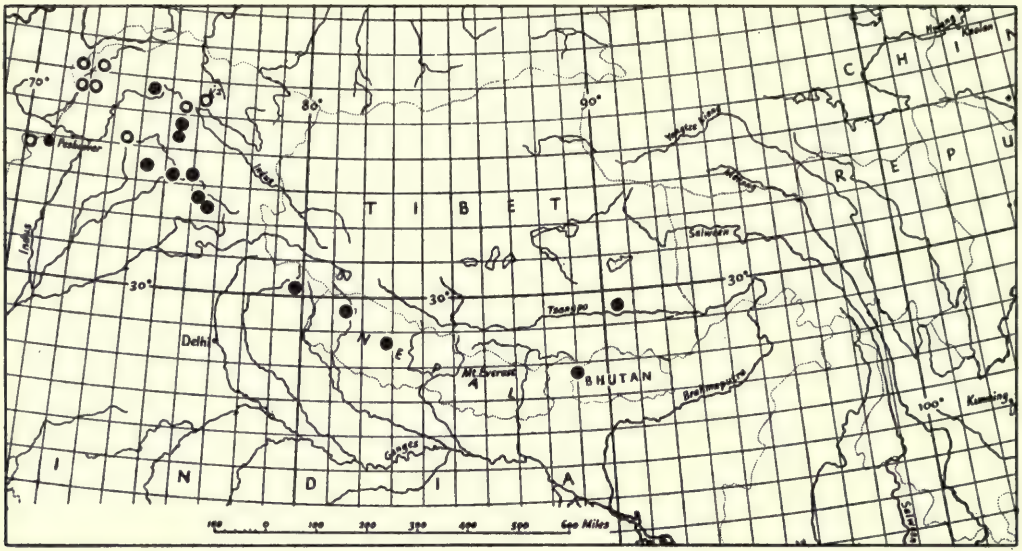

70°
80°
90°
100°
30°
K²
Peshawar
Indus
T I B E T
C H I N
R E P U
Yangtze Kiang
Mekong
Salween
Tsangpo
Delhi
N E P A L
Mt Everest
BHUTAN
Brahmaputra
Ganges
I N D I A
Kunming
Hwang Ho
Kaolan
100 0 100 200 300 400 500 600 Miles

FIG. 11. Distribution of : ● *Epilobium leiospermum* ; ○ *E. tibetanum* (in the Himalayan region).

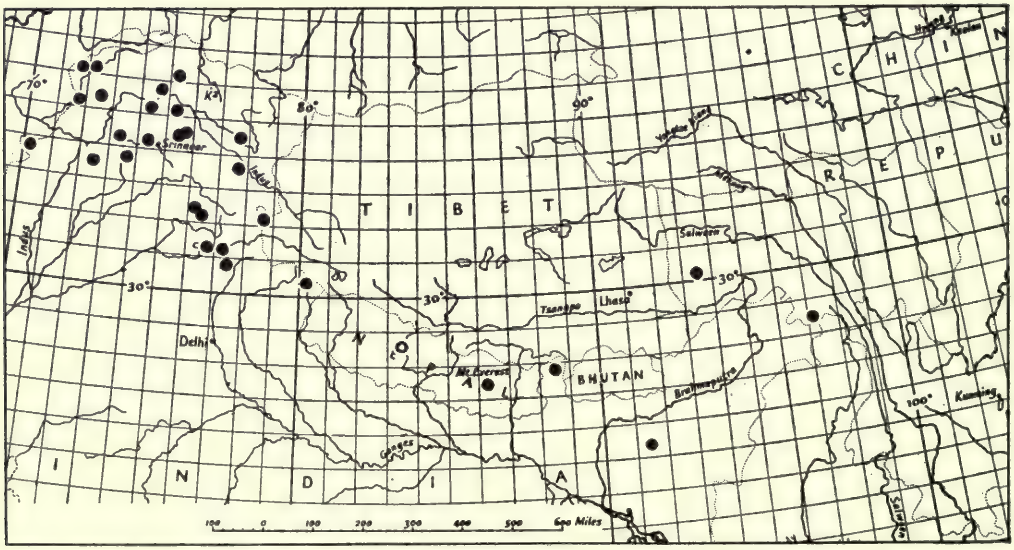

70°
80°
90°
100°
30°
K²
Srinagar
Indus
T I B E T
C H I N
R E P U
Yangtze Kiang
Mekong
Salween
Tsangpo
Lhasa
Delhi
N E P A L
Mt Everest
BHUTAN
Brahmaputra
Ganges
I N D I A
Kunming
Hwang Ho
Kaolan
100 0 100 200 300 400 500 600 Miles

FIG. 12. Distribution of : ● *Epilobium royleanum* (in the Himalayan region) ; ○ *E. sykesii.*

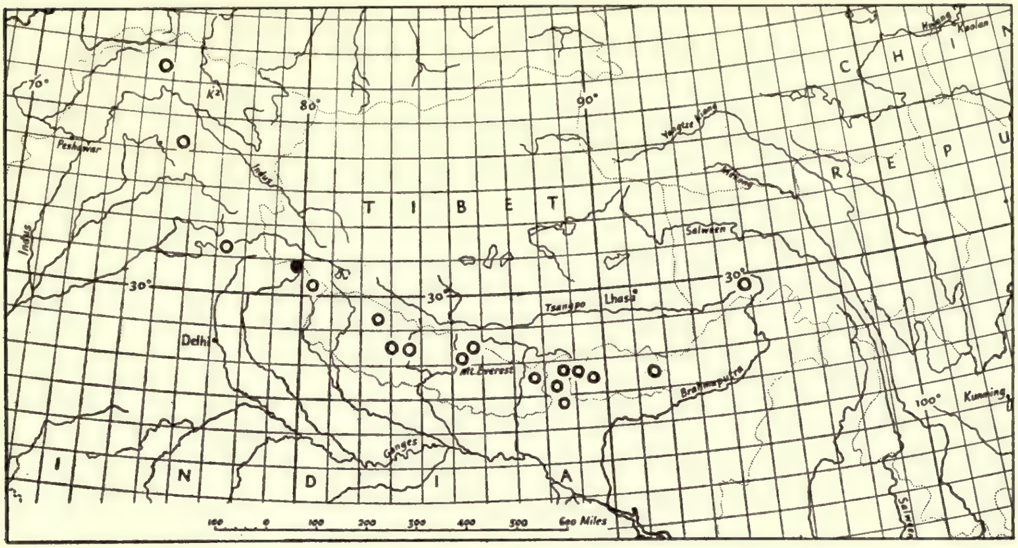


FIG. 13. Distribution of : ● *Epilobium stracheyanum* ; ○ *E. amurense* subsp. *laetum* (in the Himalayan region).

Himalaya, extending eastwards to Nepal, and both reappear in western China. *E. palustre* has a similar range to that of *E. parviflorum*, but is also found in the vicinity of Lhasa, Tibet, and again reappears in western China (fig. 5). Therefore, all five of these widely distributed species appear to have entered the Himalaya primarily from the west, and in three cases also from the east, and all of them are found in western China. In every case, however, the main area of distribution is north of the Himalaya. Their distributional areas must have been profoundly affected by the climatic changes that accompanied the Pleistocene glacial cycles. At the heights of such cycles, for example, the continuous northern Asiatic area of *E. latifolium* must have been pushed southward and into contact with its presently isolated Himalayan and west Chinese stations, just as is known to be the case in Europe for many species with a present-day arctic-montane disjunct distribution.

The ranges of the remaining 31 species of *Epilobium* found in the Himalaya may conveniently be considered in relation to the ten types of range of Himalayan montane and alpine plants distinguished by Stearn :

(1) Species of western, central and northern Asia: *E. laxum* (fig. 6), from the Tien Shan mountains into the Western Himalaya ; *E. minutiflorum* (fig. 5), from central Anatolia through western Asia to the Western Himalaya, extending as far as Kumaun.

(2) Species confined to the Western Himalaya : *E. aitchisonii* (fig. 7), *E. brevifolium* subsp. *brevifolium* (fig. 8), *E. chitralense* (fig. 7), *E. glaciale* (fig. 9), *E. leiophyllum* (fig. 10), *E. leiospermum* (fig. 11), *E. pseudobscurum* (fig. 5), *E. rhynchospermum* (fig. 9), *E. stracheyanum* (fig. 13), *E. tibetanum* (fig. 11) and *E. wattianum* (fig. 7). A total of 11 taxa ; all of the five widely distributed species discussed above also fit closely into this category in portions of their range.

(3) Species confined to Nepal on southern slopes of the main Himalayan range: *E. brevisquamatum* (fig. 6), *E. indicum* (exact locality doubtful; range not figured), *E. squamosum* (fig. 5), *E. staintonii* (fig. 5), *E. sykesii* (fig. 12) and *E. trilectorum* (fig. 5). Six species; the fact that five of them are described as new in the present paper is an interesting reflection of recent exploration in Nepal.

(4) Species of western China extending along the whole Himalaya to or into Kashmir: *E. amurense* subsp. *laetum* (fig. 13) and *E. williamsii* (fig. 7). *E. cylindricum* (fig. 10) has a similar range but extends further westward to the Afghan border and also to the Tien Shan mountains. *E. royleanum* (fig. 12), on the other hand, has a similar range to that of *E. cylindricum,* although it does not occur in the Tien Shan, but is very rare and sporadic in the Eastern Himalaya though widely distributed and common in the west.

(5) Species of western China extending along the Eastern Himalaya over much of Nepal and in some instances beyond it into Kumaun: *E. clarkeanum* (fig. 6), *E. conspersum* (fig. 2), *E. wallichianum* (fig. 4) and *E. sikkimense* (fig. 9). *E. brevifolium* subsp. *pannosum* and subsp. *trichoneurum* (fig. 8) have decidedly eastern ranges but occur further to the south than the four species enumerated above, not having true montane distributions. *E. brevifolium* subsp. *trichoneurum* extends across China and also occurs in northern Luzon.

(6) Species confined to the Eastern Himalaya: *E. gouldii* (fig. 6) and *E. trichophyllum* (fig. 6).

(7) Species extending from north-western China (Kansu) over Tibet to the Himalaya. No species of *Epilobium* is known to have this range, but it might provide an indication of the path of migration of *E. palustre* to the vicinity of Lhasa.

(8) Species of the dry plateau zone of Tibet. No species of *Epilobium* is known to have this range.

(9) Species confined to the moist river-gorge country of south-eastern Tibet: *E. kingdonii* (fig. 7) and *E. soboliferum* (fig. 3).

(10) Species occurring in the Himalaya and Ceylon or southern India. No species of *Epilobium* occurs in central or southern India or in Ceylon.

In summary, therefore, a consideration of the distributional patterns of *Epilobium* in the Himalaya may be considered to reinforce Stearn's general conclusions about such patterns in the Himalayan area. Just as in the genus *Allium,* the main area of transition for the genus *Epilobium* appears to lie in Nepal in the valley of the Kali Gandaki River at approximately longitude 83° E., which Stearn suggested as the boundary between the Western and Eastern Himalayan botanical provinces. An excellent example from the genus *Epilobium* of the importance of this area as a transition zone is provided by *E. conspersum,* a species that ranges from western China westward through the Himalaya to this area, and *E. latifolium* subsp. *speciosum,* a Western Himalayan taxon that comes into contact with *E. conspersum* near longitude 83° E. (fig. 2). These two taxa are closely related and at least one collection from the area of contact apparently represents a highly sterile interspecific hybrid between the two. In view of the apparently efficient dispersal mechanism provided by the plumed seeds of *Epilobium,* it is not surprising that the species of this genus should often have somewhat wider ranges than those of *Allium.* On the contrary, the close correspondence between the basic patterns of distribution in these two dissimilar genera of plants suggests that Stearn's classification of such patterns may be applicable generally and provide a sound working hypothesis for further distributional studies of Himalayan montane and alpine plants.

ACKNOWLEDGMENTS

This paper was written during the tenure of a United States National Science Foundation postdoctoral fellowship, spent at the Department of Botany, British Museum (Natural History), London, and at the Royal Botanic Gardens, Kew. I am most grateful to the Keeper of the former, Mr. J. E. Dandy, and to the Director of the latter, Sir George Taylor, for the privilege of working in their institutions and for the opportunity of studying the herbarium material in their care. In the preparation of this paper, I have had the benefit of much helpful advice from Mr. J. F. M. Cannon and Dr. William T. Stearn, of the Department of Botany, British Museum (Natural History) ; and Mr. Frank Ludlow and Mr. L. H. J. Williams, of the same department, have very kindly advised me about the geography of the area and the preparation of the maps reproduced here.

KEY TO THE SPECIES AND SUBSPECIES OF *EPILOBIUM* IN THE HIMALAYAN REGION

Stigma distinctly 4-lobed or 4-partite :

Leaves all alternate (rarely the basal ones opposite) ; flowers zygomorphic, large Sect. *Chamaenerion* :

Inflorescence spicate ; buds sharply deflexed, becoming erect just before anthesis ; leaves with a well-developed submarginal vein 1. *angustifolium*

Inflorescence leafy, the flowers axillary ; buds erect, becoming pendulous individually before anthesis :

Veins conspicuous on lower surface of leaf, lined with brown oil-cells ; pedicels long ; style hairy near the base . . . . . 3. *conspersum*

Veins inconspicuous on lower surface of leaf ; pedicels short :

Style hairy near the base ; stems densely strigose 2*b*. *latifolium* subsp. *speciosum*

Style glabrous ; stems usually glabrescent 2*a*. *latifolium* subsp. *latifolium*

Leaves opposite, at least below ; flowers actinomorphic . . Sect. *Epilobium* :

Stems and midribs of leaves covered with long lax hairs ; leaves narrowly lanceolate, less than 1 cm. broad, sparsely and obscurely serrulate, subsessile ; stigma broadly 4-lobed . . . . 6. *staintonii*

Stems villous-pubescent with spreading hairs ; leaves more than 1 cm. broad, coarsely serrulate ; stigma deeply 4-partite :

Leaves distinctly clasping ; flowers 7–12 mm. long, often over 10 mm. ; stigma elevated above the anthers of the longest stamens . 4. *hirsutum*

Leaves sessile but not clasping ; flowers 6–8 mm. long ; stigma surrounded at the base by the anthers of the 4 longest stamens . 5. *parviflorum*

- Stigma entire or shallowly emarginate . . . . . . Sect. *Epilobium*:
  - Leaves entire or very feebly denticulate, lanceolate, sharp-pointed; seeds 1·5–2 mm. long, with a prominent beak at the chalazal end 36. *palustre*
  - Leaves serrulate, sometimes obscurely so; seeds less than 1·5 mm. long, with a short pellucid beak or rounded at the chalazal end:
    - Flowers 3–4 mm. long, erect; ovaries often white-pubescent; seeds with a short pellucid beak at the chalazal end . . . 37. *minutiflorum*
    - Flowers mostly over 4 mm. long, or if less then seeds lacking a chalazal beak:
      - Stems pubescent all round, lacking distinct hairy lines running down from the petioles; seeds obovoid:
        - Stems and leaves densely covered with appressed velvety tomentum; flowers 10–16 mm. long; stigma broadly clavate, about 2 mm. long, elevated above the anthers at maturity 12*c*. *brevifolium* subsp. *pannosum*
        - Stems and leaves not covered with velvety tomentum:
          - Plants entirely covered with villous pubescence; underground stems invested with a long series of ovoid brown scales; plants less than 25 cm. tall . . . . 24. *trichophyllum*
          - Plants not covered with villous pubescence:
            - Leaves with an evident petiole 2–8 mm. long, the base of the lamina narrowly cuneate:
              - Stigma capitate or short-clavate, surrounded by the anthers at anthesis; seeds less than 0·5 mm. in diameter; turions absent:
                - Pubescence of stems and inflorescence predominantly strigose 11. *royleanum*
                - Pubescence of stems and inflorescence predominantly glandular 11. *royleanum* forma *glandulosum*
              - Stigma clavate, elevated above the anthers at anthesis; seeds about 0·7 mm. in diameter; pubescence largely glandular; turions present . . . . . . 10. *indicum*
            - Leaves subsessile, broadly cuneate or rounded at the base:
              - Stigma capitate; plants mostly less than 25 cm. tall, often well branched from the base; a dense tuft of scales present at the root crown . . . . 31. *williamsii*
              - Stigma short-clavate to clavate; plants usually taller than 25 cm.:
                - Plants usually strict from the base, often well branched above; leaves subcoriaceous, lanceolate, 0·7–2 cm. broad, with a cuneate base . 12*b*. *brevifolium* subsp. *trichoneurum*
                - Plants often well branched from the base; leaves not coriaceous, 1–3 cm. broad, with a rounded or nearly oblique base 12*a*. *brevifolium* subsp. *brevifolium*
      - Stems not pubescent all round, or, if so above, with more or less distinct pubescent lines decurrent from the petioles:
        - Leaves mostly subcoriaceous, narrowly lanceolate to lanceolate, coarsely and densely serrulate, evidently petiolate; stems glabrescent, at

least below, with elevated glabrous lines decurrent from the petioles ; inflorescence suberect before anthesis, mostly cinereous-pubescent ; seeds obovoid :

Seeds papillate ; base of plant usually lacking scales ; stigma short-clavate 7. *cylindricum*

Seeds smooth ; base of plant with scales or coriaceous dead leaves, at least in well-established plants :

Leaves 3–6 cm. long, 0·7–1·5 cm. broad ; flowers 6–9 mm. long ; stigma capitate . . . . 9. *leiospermum*

Leaves 1·5–3·5 cm. long, 0·3–1 cm. broad ; flowers 5–6(–8) mm. long ; stigma clavate, about 1·5 mm. long . . 8. *tibetanum*

Leaves usually broader and rarely subcoriaceous ; decurrent lines from petioles usually conspicuously pubescent :

Underground stems rhizomatous, devoid of scales, turions or coriaceous dead leaves at the base :

Seeds with a conspicuous pellucid beak at the chalazal end ; leaves lanceolate, serrulate . . . . . 18. *stracheyanum*

Seeds lacking a chalazal beak :

Plants delicate, the leaves much shorter than the internodes, elliptic, 0·9–1·3 cm. long, 0·4–0·7 cm. broad, very obscurely toothed, subsessile ; inflorescence very sparsely pubescent ; seeds smooth 35. *clarkeanum*

Plants stouter, the leaves about equalling or exceeding the internodes, serrulate :

Stigma clavate ; pubescence of inflorescence strigose :

Plants caespitose, usually less than 10 cm. tall ; pubescence very sparse or wholly lacking ; leaves sessile, mostly less than 1 cm. long ; seeds acuminate, papillose 27. *leiophyllum*

Plants not caespitose, usually more than 10 cm. tall :

Leaves sharply acuminate, narrowly cuneate at the base, with a petiole about 2 mm. long, all except those in the inflorescence opposite ; inflorescence sparsely strigose ; seeds smooth . . . . 34. *pseudobscurum*

Leaves rounded at the apex and base, subsessile, the upper ones alternate ; inflorescence conspicuously grey-pubescent 15. *sykesii*

Stigma capitate :

Pubescence of inflorescence predominantly glandular :

Plants usually more than 15 cm. tall ; leaves oblong, evidently petiolate, obtuse ; flowers usually large, the stigma elevated above the anthers at anthesis 14*b*. *wallichianum* subsp. *souliei*

Plants usually less than 15 cm. tall ; leaves ovate, subsessile, acute ; flowers small :

Seeds smooth, acuminate . . . 29. *wattianum*
Seeds papillose, ovoid . . . 30. *kingdonii*
Pubescence of inflorescence predominantly strigose; leaves evidently petiolate:
Leaves narrowly elliptic to narrowly ovate, the base narrowly cuneate; some glandular hairs present in the inflorescence; flowers 5–7 mm. long, the petals white; stigma surrounded by the anthers at anthesis 16. *amurense* subsp. *laetum*
Leaves oblong, obtuse, the base rounded; flowers (5–) 7–15 mm. long, the petals pinkish-purple; stigma elevated above the anthers at anthesis 14*a*. *wallichianum* subsp. *wallichianum*
Underground stems with brown coriaceous scales, leaves or turions at time of flowering, stout, often more or less vertical:
Plants with turions (sessile fleshy buds that overwinter) on the underground parts, often also with brownish scales:
Seeds with a short pellucid beak at the chalazal end; stems pubescent all round above; leaves 3–6 cm. long, the apex more or less obtuse . . . . . 17. *rhynchospermum*
Seeds lacking a chalazal beak:
Leaves nearly all opposite, obscurely serrulate, narrowly elliptic; turions loose; flowers 8–9 mm. long . . 19. *glaciale*
Leaves alternate above, evidently but rather sparsely serrulate; turions compact; flowers less than 7 mm. long; seeds acuminate:
Plants mostly at least 20 cm. tall; leaves ovate-acuminate, subsessile; conspicuously elevated hairy lines decurrent from the petioles; seeds finely verrucose . 22. *gouldii*
Plants mostly less than 20 cm. tall; leaves evidently petiolate, the petiole 2–4 mm. long; decurrent hairy lines not conspicuously elevated; seeds papillose; inflorescence densely strigose . . . . 28. *aitchisonii*
Plants lacking turions, although fleshy soboles may be present on the underground parts:
Plants 8–30 cm. tall (usually about 15 cm.), often well branched from the base, the underground stem mostly bare but with a dense tuft of coriaceous brown scales 1–2 cm. long at the root crown; leaves densely serrulate, subsessile; leaves mostly 1–2 cm. long:
Pubescence of inflorescence entirely strigose 32. *chitralense*
Pubescence of inflorescence with a conspicuous admixture of glandular hairs . . . . . 31. *williamsii*
Plants not as above, usually unbranched from the base and lack-

ing a dense tuft of scales at the root crown, although such a tuft may be present just below ground level :

Inflorescence nodding at anthesis ; bracts subtending the curved ovaries mostly less than half their length ; underground stems with an imbricate series of coriaceous brown scales 1–2 cm. long ; leaves weakly serrulate ; stigma elevated well above the anthers on a style 6 mm. long . . 33. *squamosum*

Inflorescence erect or slightly nodding at anthesis ; bracts more than half the length of and mostly concealing the ovaries they subtend :

Underground stem rhizomatous, with short scattered brown scales ; leaves subsessile, narrowly ovate-acuminate, densely serrulate ; inflorescence glandular-pubescent :

Leaves finely serrulate ; flowers 5–6 mm. long ; petals white 21. *brevisquamatum*

Leaves coarsely serrulate ; flowers 6–16 mm. long ; petals pinkish-purple . . . . . 20. *laxum*

Underground stem with a dense tuft of scales or coriaceous brown leaves :

Nearly vertical underground stem invested with brown coriaceous scales for a distance of 2–4 cm. ; leaves broadly elliptic, conspicuously shorter than the internodes above them ; pubescence of inflorescence glandular, very sparse . . . . . 25. *trilectorum*

Tuft of scales shorter than 2 cm. ; leaves not broadly elliptic, equal to or exceeding the internodes :

Plants with a basal tuft of coriaceous brown leaves from which slender soboles later arise at the time of flowering ; base of hypanthium campanulate ; sepals obtuse . . . . 26. *soboliferum*

Slender soboles lacking at time of flowering ; base of hypanthium narrowly infundibuliform ; sepals acute or acuminate ; seeds obovoid :

Flowers 4–6 mm. long ; only a few scales present at the summit of the root crown ; base of leaves cuneate, with an evident petiole up to 6 mm. long ; seeds coarsely papillose . 11. *royleanum* forma *glabrum*

Flowers more than 6 mm. long ; a tuft of brown leaf-like scales present at or just below ground level:

Brown serrate finely pubescent dead leaves present at base of stem just above ground level ; leaves distinctly petiolate ; base of style glabrous 13. *kermodei*

Brown entire glabrous spathulate scales present in a dense tuft just below ground level ; leaves subsessile, often more or less glabrous ; base of style usually with a few glassy hairs :

Plants 15–60 cm. tall ; thick fleshy soboles sometimes arising from underground stem at time of flowering ; leaves narrowly ovate, 3–7 cm. long, 1·5–3 cm. broad, densely serrulate ; seeds finely papillose 23*b*. *sikkimense* subsp. *ludlowianum*

Plants 8–25 cm. tall ; soboles absent ; leaves narrowly elliptic to elliptic, 1·5–3 cm. long, 0·5–1·5 cm. broad, sparsely serrulate 23*a*. *sikkimense* subsp. *sikkimense*

EPILOBIUM L.

1. **Epilobium angustifolium** L., Sp. Pl. i : 347 (1753).—C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 582 (1879).—Aitch. in Journ. Linn. Soc. Lond., Bot. xviii : 60 (1880) cum var.—Hausskn., Monogr. Epil. : 37 (1884). [Type from Europe.]

Chamaenerion angustifolium (L.) Scop., Fl. Carniol., ed. 2, i : 271 (1772).—Steinb. in Fl. URSS xv : 622 (1949).—Wendelbo in Nytt Mag. Bot. i : 46 (1952).—Ross-Craig, Drawings Brit. Pl. xi : t. 31 (1958).

Epilobium spicatum Lam., Fl. Franç. iii : 482 (1778).—H. Lév., Ic. Gen. Epil. : t. 226 (1911). [Type from France.]

Geographical range : widespread in the temperate regions of the Northern Hemisphere.

WEST PAKISTAN : *Chitral :* Shokor Shal, Barum Gol, 3,500 m., 23 July 1950, *Wendelbo* (BM ; K). Mandaglasht, 2,600–2,750 m., July 1908, *Toppin 519* (K). Yarkhun, 4,000 m., 22–27 Aug. 1954, *Schmid 2288* (BM ; G). Chumarkhan Pass, east of Mastuj, 3,050 m., 14 July 1958, *Stainton 2895* (BM ; E ; W). *Peshawar :* Kurram Valley, 1879, *Aitchison 781* (BM ; G ; K), *1008* (BM ; G ; K). Pre Ghal, Suleiman Mountains, Waziristan, 1927, *Hay* (BM). Sho Nullah, 2,400–2,750 m., 24 July 1953, *Stewart & Rahman 25183* (BM) ; 3,050 m., 23 Aug. 1955, *Rahman 24* (BM), *115* (BM). Naran, Kagan Valley, 20 July 1954, *Shaukat Ali 108* (BM). Bhimhal, Kagan, 21 Aug. 1897, *Duthie* (K). Naran, 30 June–5 July 1953, *Schmid 276* (G).

JAMMU AND KASHMIR : *Gilgit :* Naltar Valley, 2,750–3,050 m., 3 Aug. 1892, *Duthie* (BM ; E). Nanga Parbat, near Rama, 3,350 m., 13 Aug. 1955, *Webster & Nasir 6464* (W). Dashhin, 2,300 m., *Giles 558* (K). Doyan, 2,450–2,750 m., *Giles 211* (K). Gilgit, 1909, *Toppin 1016* (K). *Baltistan* : Kero Lungma Glacier, 3,650–3,950 m., 24 July 1939, *Scott Russell 1305* (BM) ; 3,950 m., 27 July 1939, *Scott Russell 1356* (BM). Hispar Glacier, 3,350 m., 17 July 1939, *Scott Russell 1185* (BM). Biafo Glacier, 4,100 m., 5 Sept. 1939, *Scott Russell 1813* (BM) ; 4,400 m., 8 Sept. 1939 , *Scott Russell 1836* (BM). Sokha Glacier, 4,550 m., 21 Aug. 1939, *Scott Russell 1616* (BM). Tap to Masenno Glacier, Astor, 17–19 Sept. 1856, *Schlagintweit 7326* (G). Near Tashing, north-west of Astor, 16–24 Sept. 1856, *Schlagintweit* (E). Das to Astor, 8–20 Sept.

1856, *Schlagintweit* (BM). *Ladakh :* Kangi La, 4,850 m., 10 Sept. 1931, *Koelz 2846a* (E). *Zaskar :* East of Pensi La, west of Padam, Aug. 1865, *Stolitzka* (K). Kangi La to Rangdum, 3,650 m., 11 Sept. 1931, *Koelz 2863a* (W). *Kashmir :* Pir Panjal, *Hügel 919* (W). Barai Valley, 3,500 m., *Ludlow & Sherriff 1493* (E). Killanmarg, 3,450 m., 15 Aug. 1956, *Polunin 56/290* (BM). Gulmarg, 2,600 m., 8 Aug. 1919, *Rich 1237* (K). Sonamarg, 2,750 m., 24 Aug. 1875, *Clarke 27195* (K). Pahlgam, 3,350 m., 12 Aug. 1920, *R. R. & I. D. Stewart 5679* (K). Baltal to Matayan, Sept. 1880, *Young* (BM). Erin Valley, 3,050 m., 25 July 1940, *Ludlow & Sherriff 7826* (BM ; E). Kolahoi Valley, 3,650 m., 27 Aug. 1956, *Polunin 56/568* (BM ; E). Gyama Tongdze, Purig, 25–27 July 1933, *Koelz 6022* (G). Zoji La, 27 Sept. 1848, *Thomson* (K). Kilar, upper Chenab Valley, 2,450 m., 10 July 1879, *Ellis 340* (K). Purti, upper Chenab Valley, 2,150 m., 30 July 1881, *Ellis 1518* (K).

HIMACHAL PRADESH : Pangi Forest, Chamba, 2,750–3,050 m., Sept. 1897, *Lace 1777* (E ; K). Urnu Forest, Chamba, 2,450 m., 16 July 1899, *Harsukh* (K). Luj Forest, Chamba, 3,050 m., 11 July 1899, *Harsukh* (K). Baspa River opposite Dangdangshi, Bassahr, 28 July 1890, *Lace 440* (E). Chitkal, Baspa Valley, 3,800 m., 16 July 1939, *Sherriff 7434* (BM ; E). Shipki La, 2,950 m., July–Aug. 1847, *Maclagan 656* (E).

PUNJAB : Gurungantal, Lahul, 9 July 1888, *Drummond 22933* (K). Gundla, Lahul, 3,050 m., 31 Aug. 1916, *Cooper 5532* (E). Sisu, Lahul, 3,050 m., 7 Aug. 1916, *Cooper 5186* (E) ; 8 July 1941, *Bor 10294* (E ; K). Kyelang, Lahul, 3,100 m., 4 July 1941, *Bor 14977* (E ; K). Jispa, Lahul, 3,550 m., 16 July 1938, *Bor 9454* (E ; K). Patsio, Lahul, 3,650 m., 3 July 1941, *Bor 13165* (E ; K). Zingzingbar, Lahul, 4,550 m., 23 July 1941, *Bor 16374* (E ; K). Yotse Valley, Lahul, 29 July 1888, *Drummond 22994* (E ; G). Lahul, *Jaeschke* (E).

UTTAR PRADESH : *Tehri Garhwal :* Ganga Valley, 2,750–3,050 m., 16 July 1883, *Duthie 1041* (BM ; G). *Kumaun :* Niti, 3,500 m., *Strachey & Winterbottom 2* (BM ; K). Rimkim, 4,150 m., *Strachey & Winterbottom 2* (K). " Near Naihil, Byans " (?), 3,650 m., 30 July 1886, *Reid* (E).

S.E. TIBET : East of Yatung, 3,050 m., 3 Aug. 1938, *Chapman 370* (K). Near Chumbi, 20 July 1882, *Dungboo* (K). Girk, Chumbi, 30 July 1877, *Dungboo 4659* (BM). Three miles from Phari Dzong, 19 Aug. 1878, *Dungboo* (K). Philey La, 3,800 m., 26 July 1914, *Cooper 1918* (BM) ; 3,950 m., 23 Oct. 1914, *Cooper 3472* (E). Lhakang Dzong, 3,950 m., 1 Sept. 1933, *Ludlow & Sherriff 510* (BM). Reting, 60 miles north of Lhasa, 3,950 m., 27 July 1942, *Ludlow & Sherriff 8901* (BM; E; G) ; 4,100 m., 20 July 1944, *Ludlow & Sherriff 11038* (BM ; E). Lung, Chayul Chu, 2,750 m., 9 July 1936, *Ludlow & Sherriff 2322* (BM ; E). Tsobunang, Tsari, 3,950 m., 16 Aug. 1936, *Ludlow & Sherriff 2060* (BM ; E). Kyimdong Dzong, 3,650 m., 21 Sept. 1936, *Ludlow & Sherriff 2624* (BM). Lilung Chu, Tsangpo Valley, Kongbo, 3,050 m., *Ludlow, Sherriff & Taylor 5697* (BM ; E). Je, Pasum Tso, Kongbo, 3,650 m., 7 July 1947, *Ludlow, Sherriff & Elliot 14085* (BM ; E ; G). Lotü, Kongbo, 3,650 m., 21 July 1947, *Ludlow, Sherriff & Elliot 15500* (BM ; E). Lusha, Kongbo, 2,900 m., 17 June 1938, *Ludlow, Sherriff & Taylor 4860* (BM ; E ; G). Shari Dzong, Pashö District, Kham, 3,800 m., 26 June 1936, *Hanbury-Tracy 78* (BM).

NEPAL : Above Ranmagaon, 3,350 m., 2 July 1954, *Stainton, Sykes & Williams*

3345 (BM ; E). Ghunsa, east of Walungchung Gola, Tamur Valley, 3,650 m., 31 July 1956, *Stainton 1159* (BM ; E).

SIKKIM : Without definite locality, *Cave 714* (BM).

BHUTAN : Sharna to Tremo La, 2,900–3,700 m., *Gould 1069* (K). Chebisa, Thimbu, 3,950 m., 24 July 1914, *Cooper 1803* (BM ; E). Tranza, Gafoo La, upper Pho Chu, 3,950 m., 16 Sept. 1949, *Ludlow, Sherriff & Hicks 17248* (BM ; E). Pangotang, Tsampa, 3,800 m., 13 Sept. 1949, *Ludlow, Sherriff & Hicks 19735* (BM ; E).

BURMA : Upper Burma, also at Atuntze, 2,750–3,050 m., 20 June 1914, *Kingdon-Ward 1687* (E). Near Hpawte Bungalow, Myitkyina Distr., 13 July 1938, *Pa 17423* (K).

This circumboreal species is common both in the eastern Himalaya and in the west, but absent or rare over much of Nepal and Sikkim. An interesting collection from Kashmir (Rajparyan Sanctuary, upper Bringhi, 3,050 m., 23 Aug. 1943, *Ludlow & Sherriff 9348* (BM ; E)) has a very leafy inflorescence and is entirely sterile; its status is doubtful. Among the plants of *E. angustifolium* from the eastern part of the Himalaya, as also in some of those from Yunnan and Szechwan, there is some indication of hybridization between this species and *E. conspersum*. Plants of *E. angustifolium* from this area often have relatively long pedicels ; nodding, partly closed flowers ; a tardily erect stigma ; a rather inconspicuous submarginal vein in the leaves ; and often a strigose-pubescent stem, at least above. Nevertheless, such collections appear to be referable to *E. angustifolium*, and because these characteristics are found in different combinations, the plants in question do not seem to be separable, even at the subspecific level, at present.

2. **Epilobium latifolium** L., Sp. Pl. i : 347 (1753).—C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 583 (1879).—Hausskn., Monogr. Epil. : 190, t. 1 fig. 16 (1884).—H. Lév., Ic. Gen. Epil.: t. 225 (1911). [Type from Kamtchatka.]

> *Chamaenerion latifolium* (L.) Fr. & Lange in Fl. Dan. xvii, 49 : 7 (1877).—Steinb., Fl. URSS xv : 626 (1949).—Wendelbo in Nytt Mag. Bot. i : 46 (1952).

Geographical range : circumboreal, but lacking from the European Arctic between Iceland and the mouth of the Kara River in Siberia ; extending into the Himalaya from Nuristan, Afghanistan, to central Nepal, and to Kongbo Province, Tibet, from western China, where local.

2*a*. **Epilobium latifolium** subsp. **latifolium.**

Geographical range : that of the species, but absent in the Himalaya between Punjab and Kongbo Province, Tibet.

WEST PAKISTAN : *Chitral :* Gangalwat Gol, south-west of Chitral, 3,050 m., 18 June 1958, *Stainton 2707* (BM ; E ; W). Zapotili, Barum Gol, 3,500 m., 9 July 1950, *Wendelbo* (BM ; K). Mandaglasht, 3,050—3,350 m., *Toppin 645* (K). Above Bomosto, ascent to Tirich Mir, 3,500 m., 29 Aug. 1935, *Kerstan 1532* (W). Tirich Gol, 3,500 m., 5 July 1958, *Bowes Lyon 1066* (BM ; E ; W). Yarkhun, 4,000 m., 22–27 Aug. 1954, *Schmid 2287* (BM ; G). *Peshawar :* Sho Nullah, 3,050 m., 24 July 1953, *Stewart & Rahman 25184* (BM).

Jammu and Kashmir: *Gilgit:* Sauy-o-Sir (valley of the Sai?), 3,050–3,650 m., *Giles 612* (K). Sar Saifar Maluk Ka Kattha, 4,000 m., 22 Aug. 1896, *Duthie 19467a* (K). Manu Gam Nullah, 3,200 m., 31 Aug. 1950, *Thornley 15* (BM). *Baltistan:* Haramosh, 1957, *Culbert* (BM). Kero Lungma Glacier, 3,650–3,950 m., 24 July 1939, *Scott Russell 1304* (BM). Hispar Glacier, 3,350 m., 17 July 1939, *Scott Russell 1206* (BM). Thale La to Bagmaharal, 30 Aug. 1856, *Schlagintweit* (BM). Sokha Glacier, 4,550 m., 21 Aug. 1939, *Scott Russell 1644* (BM). Crevasse Glacier, north of East Mustagh La, 3,950 m., 20 July 1937, *Spender* (BM). Hushe Valley, foot of Masharbrum, 23 July 1955, *Webster & Nasir 6260* (K; W). Baltoro Glacier, *Conway 252* (K). Baltistan, 3,350 m., 19 June 1890, *Hunter-Western 10216* (K). *Ladakh:* Saser La, 4,400 m., 25 July 1928, *Ludlow 427* (BM). Mamostong Glacier, Saser La, 4,200 m., 24 July 1929, *Ludlow 556* (BM). Head of Rongdu Nullah, Shyok River, 4,850 m., 8 Aug. 1947, *Schomburg 38* (BM). *Zaskar:* Rangdum, 4,550 m., 12 Sept. 1931, *Koelz 2919* (E; K). *Kashmir:* Sonsa Nag, 3,800 m., 19 Aug. 1923, *Coventry 632* (K). Pir Panjal, *Hügel 926* (W). Kamri Valley, 2,750–3,050 m., 24 Aug. 1892, *Duthie* (BM; E). Burzil Pass, 3,650 m., 1 Aug. 1876, *Clarke 29881* (K), *29892* (BM); 3,950 m., Aug. 1905, *Meebold* (G). Thajwas, near Sonamarg, 3,800 m., 13 Aug. 1940, *Ludlow & Sherriff 7924* (BM; E). Sonamarg, 3,200 m., 27 July 1921, *Stewart 6725* (K); 3,050–3,650 m., 23 July 1928, *Stewart 13124* (G); 3,650 m., 2 Sept. 1917, *Stewart 3525* (K). Barai, Kishinganga Valley, 2,900 m., 20 July 1935, *Ludlow & Sherriff 1444* (E). Kolahoi, 3,350–3,650 m., 8 Aug. 1893, *Duthie 13496* (E; G); 3,050 m., 7 July 1902, *Drummond 14141* (K). Badzulkod Nullah, 3,650–3,950 m., 1 Aug. 1893, *Duthie 13396* (BM). Suru Valley, 3,350 m., 4 July 1928, *Osmaston 181* (K). Mahthantir Gah, 3,240–4,000 m., 9–10 Aug. 1954, *Schmid 2204* (G).

Punjab: Kenlung, Lahul, 4,550 m., 21 July 1941, *Bor 15409* (E). Palamao, 27 June 1888, *Drummond 25035* (K). Baralacha Pass, Lahul, 4,550 m., *Kashyap 25* (K); 3,050 m., 16 July 1938, *Bor 13971* (K).

S.E. Tibet: Egar, Nyoto Chu, Kongbo, 3,650 m., 19 Aug. 1947, *Ludlow, Sherriff & Elliot 15632* (BM; E). Ba La, Pasum Chu, Kongbo, 4,100 m., 26 June 1947, *Ludlow, Sherriff & Elliot 14014* (BM; E).

The Himalayan representatives of *E. latifolium* subsp. *latifolium* do not appear to be morphologically distinct from populations further to the north in Asia. These plants often form great coloured masses in more or less unstable ground, particularly about glaciers, in the Western Himalaya; but the species is very rare in the eastern parts of the Range. The plants from Kongbo Province, Tibet, have strigose stems and somewhat larger flowers than those from the west, but agree closely with western plants of subsp. *latifolium* in habit and general appearance and in their glabrous styles.

2b. **Epilobium latifolium** subsp. **speciosum** (Decne.) Raven, stat. nov.

Epilobium gerardianum Wall., Numer. List: 216, n. 6326 (1832), *nom. nud.*
Epilobium speciosum Decne. in Jacquem., Voy. Ind. iv, Bot.: 57, t. 69 (1844).

Geographical range: Himalaya from Kashmir to central Nepal.

Jammu and Kashmir: *Kashmir:* Bhujaz, foot of Umasi La, Zaskar frontier, 3,350 m., 17 July 1943, *Ludlow & Sherriff 9198* (BM ; E). Dranti Pass, upper Chenab Valley, 3,650 m., *Baden-Powell 163* (K). Kilar, 10 July 1879, *Ellis 340* (K). Ajog Valley, Chenab Valley, 3,050 m., 30 June 1881, *Ellis 1495* (K).

HIMACHAL PRADESH : Near Yurpo, 3,800 m., *Jacquemont 1739* (G ; K ; P, holotype, not seen). Pangi, Chamba, 3,650–4,550 m., 19 July 1899, *Harsukh* (K). Mangsu Pass, Baspa Valley, Simla, 4,400 m., 18 July 1939, *Sherriff 7455* (BM). Sirmur, *Gerard* in *Wallich 6326* (K, *E. gerardianum*).

PUNJAB : Hamta, Kulu, 4,250 m., 29 July 1916, *Cooper 5177* (E). Gurungatal to Gundla, Lahul, 10 June 1888, *Drummond 22995* (E ; K). Koksar, Lahul, 3,050 m., 2 Aug. 1916, *Cooper 5219* (E) ; 3,350 m., 29 July 1941, *Bor 16519* (E ; K). Billing Lumpe, Lahul, 4,850 m., 13 July 1941, *Bor 15382* (E ; K). Patsio, Lahul, 3,650 m., 3 July 1941, *Bor 13151* (E ; K). Baralacha Pass, Lahul, 4,250 m., 21 Aug. 1916, *Cooper 5407* (E). Chandra Valley, Lahul, 3,350 m., 17 Aug. 1952, *Graaff 1* (BM) ; 3,950 m., 18 Aug. 1952, *Graaff 2* (BM).

UTTAR PRADESH : *Tehri Garhwal :* West side of Rudugaira Gad, 4,100 m., 2 Sept. 1952, *Huggins 34* (BM). Rudugaira Gad, 3,350–3,650 m., 19 June 1883, *Duthie 1042* (G ; K). East side of Rudugaira Gad, 4,100 m., 9 Sept. 1952, *Huggins 137* (BM). Damdar Valley, 3,050–3,350 m., 3 July 1883, *Duthie 1042* (K). Lekhun Gad, 3,650–3,950 m., 11 Aug. 1883, *Duthie 1042* (K). Kharga Stream below Sri Kanta, 3,950–4,250 m., 8 Aug. 1883, *Duthie 1042b* (BM; G). Above Mussooree, 3,950 m., 1884, *Edgeworth 14* (K). *Kumaun :* Mulapa Gad, Dharma, 3,650 m., 5 Aug. 1886, *Duthie 5579* (E ; K). Milam, 3,950 m., *Duthie* (K). Kumaun, 1900, *Duthie* (K).

NEPAL : Bhurchula Lekh, near Jumla, 3,650 m., 15 July 1952, *Polunin, Sykes & Williams 4699* (BM ; E ; G). Near Giri Daha, 3,650 m., 1 Oct. 1952, *Polunin, Sykes & Williams 5482* (BM ; E). Tankia, Mugu Khola, 4,100 m., 21 Aug. 1952, *Polunin, Sykes & Williams 5353* (BM ; E ; G). Above Dogadi Khola, 4,250 m., 29 Sept. 1954, *Stainton, Sykes & Williams 4649* (BM ; E). Tegar, north of Mustang, 4,250 m., 8 Oct. 1954, *Stainton, Sykes & Williams 8116* (BM). Namdo, north of Mustang, 4,850 m., 9 Aug. 1954, *Stainton, Sykes & Williams 2296* (BM ; E ; G).

This taxon has been for the most part ignored since its original description in 1844, which first set forth its distinctive characteristics clearly. Modern collections, particularly those from western Nepal, enable it to be recognized as a distinct geographical entity. Plants of *E. latifolium* subsp. *speciosum* tend to have much larger flowers than are normal for subsp. *latifolium*. These two subspecies, however, completely intergrade where they approach one another in the region of Kashmir and particularly Lahul in Punjab, some collections, like *Bor 13151*, being largely intermediate.

3. **Epilobium conspersum** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 51 (Feb. 1879) ; Monogr. Epil. : 190, t. 6 fig. 46 (1884).—H. Lév., Ic. Gen. Epil. : t. 57 (1910).

Epilobium reticulatum C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 583 (May 1879), *nom. illegit.*—Sm. & Cave in Rec. Bot. Surv. Ind. iv : 198 (1911).—W. W. Sm. in Rec. Bot. Surv. Ind. iv : 373 (1913).

Chamaenerion reticulatum Kitamura in Kihara, Fauna & Fl. Nepal Himal. i : 185 (1955), *nom. illegit.*

Geographical range: Sino-Himalayan region from central Nepal eastwards to Szechwan and Yunnan.

S.E. TIBET: Mount Everest Expedition, 3,650–3,950 m., Aug. 1921, *Wollaston 99* (K). Praigchu, 4,250 m., 1913, *Ribu & Rohmoo 6606* (E). Jakeyupyak, 3,650 m., 6 Sept. 1911, *Ribu & Rohmoo 5093* (K). Chumbi, Oct. 1904, *Bell* (K). Yatang, *Hobson* (K). Lemdung, Chumbi Valley, Aug. 1879, *Dungboo* (K). Takar La, west Tsari, 3,950 m., 15 Aug. 1936, *Ludlow & Sherriff 2083* (BM; E). Pangkar, Drukla Chu, Kongbo, 3,650 m., 21 Aug. 1938, *Ludlow, Sherriff & Taylor 6873* (BM; E). Lusha La, Kongbo, 3,950 m., 19 Sept. 1938, *Ludlow, Sherriff & Taylor 7121* (BM). Deyang La, Kongbo, 3,500 m., 8 Aug. 1947, *Ludlow, Sherriff & Elliot 14257* (BM; E). Tibet, 28°25′ N., 97°55′ E., 3,950 m., 10 Oct. 1931, *Kingdon-Ward 10118* (BM).

NEPAL: East of Chalike Pahar, 4,100 m., 3 Aug. 1954, *Stainton, Sykes & Williams 3726* (BM; E); 23 Sept. 1954, *Stainton, Sykes & Williams 4552* (BM; E). Dudh Khola, 3,650 m., 24 Aug. 1950, *Lowndes 1424* (BM; E; G). Soongoorey, 3,050 m., 1929, *Lall Dhwoj 202* (BM; E). Ganesh Himal, Shiar Khola, 3,650 m., 14 July 1953, *Gardner 1286* (BM). Khorpoo, 3,950–4,550 m., 14 Oct. 1927, *Lall Dhwoj 51* (E). Langtang Valley, 3,650 m., 23 June 1949, *Polunin 554* (BM; E). Panghoozey, 4,250–4,850 m., 1930, *Lall Dhwoj 0190* (BM; E). Julke, 3,500 m., 28 Sept. 1937, *Sharma 61/94* (BM). Beding to Nangaon, 3,650 m., 20 Sept. 1954, *Zimmermann 1394A* (G). Yangma Khola, Tamur Valley, 3,800 m., 23 July 1956, *Stainton 1090* (BM; E). Kambachen, east of Walungchung Gola, Tamur Valley, 3,650 m., 29 July 1956, *Stainton 1149* (BM). Yalung Glacier, 5,300 m., 6 Sept. 1905, *Jacob-Guillarmon Ep. 1* (G); 5,200 m., 7 Sept. 1905, *Jacob-Guillarmon* (G).

SIKKIM: Kangbachen to Lhonakh, 3,600–4,200 m., 1949, *Wyss-Dunant 1104* (G). Zemu Valley, 3,350 m., 10 July 1909, *Smith & Cave 1172* (E); 3,650 m., 15 July 1909, *Smith & Cave 2730* (BM; E; G). Ghundza, Lhonakh, 5 July 1949, *Wyss-Dunant 1191* (G). Kongra Lama ("Lama Konyr"), 4,250 m., 27 July 1849, *Hooker* (K, holotype). Langnak La to Thango, 3,950 m., 30 Aug. 1947, *Cave 70/47* (E). Fernie Glacier, Yumtang, 4,700 m., 2 Aug. 1913, *Cooper 407* (BM; E). Yumtang, 3,950 m., 13 Sept. 1947, *Cave 170/47* (E). Ningbil, 3,650–3,950 m., *Smith 4173* (E). Alpine Sikkim, *Elwes* (K). Without definite locality, 3,050–4,250 m., *Hooker* (BM; W); 1889, *King's collector* (G).

BHUTAN: Sharna to Tremo La, 2,800–3,650 m., 12 June 1938, *Gould 1067* (K). Phage La, Mangde Chu, 4,250 m., 1 Sept. 1949, *Ludlow, Sherriff & Hicks 17213* (BM).

BURMA: Adung Valley, sources of the Irrawaddy, 3,650–3,950 m., 3 Aug. 1931, *Kingdon-Ward 9900* (BM).

This fine species is for the most part set off sharply from its relatives, although the possibility of hybridization with *E. angustifolium* is discussed under that species. What is apparently a first-generation hybrid with *E. latifolium* subsp. *speciosum* has been collected in the area of contact of these two species in west-central Nepal: isolated plant on open loose scree, east of Chalike Pahar, 4,100 m., 3 Aug. 1954, *Stainton, Sykes & Williams 3738* (BM); loose sandy scree, east of Chalike Pahar, 4,250 m., 23 Sept. 1954, *Stainton, Sykes & Williams 4560* (BM). Both of these collections were probably from a single clump. The pollen of this putative hybrid is about 4 per cent fertile, as compared with over 90 per cent, as is normal in both of the suspected parents, and the plant is morphologically intermediate between them. Judging from the collection made in September, the plant was not setting any good fruit.

4. **Epilobium hirsutum** L., Sp. Pl. i: 347 (1753).—C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 583 (1879).—Hausskn., Monogr. Epil. : 53, t. 1 fig. 20 (1884).—H. Lév., Ic. Gen. Epil. : tt. 230, 231 (1911).—Steinb. in Fl. URSS xv : 578 (1949).—Ross-Craig, Drawings Brit. Pl. xi : t. 18 (1958). [Type from Europe.]

Epilobium tomentosum Vent., Descr. Pl. Nouv. Jard. Cels : t. 90 (1802). [Type from Persia, cultivated in France.]
Epilobium sericeum Benth. ex Wall., Numer. List : 216, n. 6325 (1832), ***nom. nud.***
Epilobium laetum Wall., loc. cit., n. 6329 (1832), ***nom. nud.***, quoad B.
Epilobium hirsutum var. *tomentosum* (Vent.) Boiss., Fl. Or. ii : 746 (1872).
Epilobium hirsutum var. *sericeum* C. B. Clarke, tom. cit. : 584 (1879).—Aitch. in Journ. Linn. Soc. Lond., Bot. xviii : 60 (1880).
Epilobium hirsutum var. *laetum* C. B. Clarke, loc. cit. (1879).

Geographical range : Europe to China and Japan, and southwards to eastern and southern Africa ; introduced in North America.

West Pakistan : *Chitral :* Rumbur, just south-west of Chitral, 1935, *Kerstan 253* (garden progeny, W). Mirkhani, 1,200 m., June–July 1908, *Toppin 439* (K). Koghozi, Yarkhun Gol, 1,660 m., 26 Sept. 1935, *Kerstan 2066* (W) ; 1,680 m., 3 Nov. 1954, *Schmid 2386* (G). Chitral Village, 1,500 m., 22 Aug. 1958, *Stainton 3178* (BM). Golen Gol, 1908, *Toppin 636* (K). *Peshawar :* Kurram to Habibkalla, up to 2,100 m., 1879, *Aitchison 875* (BM). Jiran Tangi, Kurram Valley, 5 Oct. 1894, *Harsukh 15322* (K). Tirah, *Duthie 35* (K, nearly glabrous). Barikot, 900 m., 3 Aug. 1953, *Stewart & Rahman 25437* (BM, nearly glabrous). Kalam, 2,100 m., 24 Aug. 1955, *Rahman 39* (BM), *116* (BM). Rawalpindi, *Aitchison 71* (K).

Jammu and Kashmir : *Gilgit:* between Gilgit and Imit, 1,620–2,580 m., 28 July 1954, *Schmid 2038* (BM ; G). Shinu Ka Kattha, Kagan, 4 July 1899, *Duthie* (K). " Hengil ", 1,600 m., *Giles 533* (K). Manu Gam Nullah, 1,650–2,400 m., 1 Sept. 1950, *Thornley 42* (BM). *Baltistan :* Skardu, 18 Sept.–13 Oct. 1953, *Schmid 717* (G). *Kashmir :* Jabar, 28 Aug. 1899, *Duthie* (K). Domel, Aug. 1851, *Fleming 355* (E) ; Aug. 1880, *Young* (K). Kotli Hills, Mirpur District, 900–1,200 m., 29 Sept. 1956, *Siddiqui 27689* (G). Pir Panjal, *Hügel 839* (W). Shadipur, Jhelum Valley, 1,550 m., 14 July 1940, *Ludlow & Sherriff 7795* (BM). Wangat Valley, 1,500–2,100 m., 11 Aug. 1940, *Pinfold 246* (BM). Kulan, Sind Valley, 2,300 m., 31 Aug. 1956, *Polunin 56/612* (BM ; E). Bringhi River, 1,800 m., 27 Aug. 1943, *Ludlow & Sherriff 9382* (BM). " Tekhi to Suleiman " (in Srinagar ?), *Young* (BM). Srinagar, 1,700 m., 25 Aug. 1917, *Stewart 3365* (K). Near Srinagar, 2–20 Oct. 1856, *Schlagintweit* (BM ; G). Nowboog, 2,000 m., 13 Sept. 1876, *Clarke 31243* (BM). Baltal, 1 Sept. 1889, *Duthie* (K). " Deval " (on Rawalpindi-Srinagar road), Aug. 1880, *Young* (BM).

Himachal Pradesh : Dalhousie, 1,200 m., 4 Sept. 1874, *Clarke 22793* (E) ; 20 Sept. 1874, *Clarke 22788* (BM), *22793* (K) ; 1879–80, *Drummond 24809* (K). Raipur, 900 m., 15 Oct. 1874, *Clarke 23672* (K, glabrous). Sirmur, *Gerard* in *Wallich 6325* (K, *E. sericeum*). Chamba to Padri Pass, 9–16 July 1856, *Schlagintweit 3642*

(BM). Chamba, 900 m., 11 Oct. 1874, *Clarke 23732* (BM, glabrous). Simla, 20 Oct. 1849, *Thomson* (K); 1887, *Drummond 20820* (K), *20821* (K). Near Simla, 7–20 Sept. 1864, *Stolitzka* (W). Bhojgura near Pilkwenta Pap, 3,200 m., *Madden 90* in part (E). Kotgarh, 2 Oct. 1831, *Dalhousie* (K). Sutlej Valley near Rampur, Aug. 1847, *Thomson 1790* (K). Valley of Sutlej and Pabur, Sept. 1844, *Munro 1046* (K). Wangtu, Bassahr, *Drummond 1979* (G; K). Kanawar, 2,300 m., *Madden* (K). Manglad Valley, 1,200 m., 29 Sept. 1891, *Lace 1054* (E). Near Ribba, 2,700 m., 27 Aug. 1890, *Lace 572* (E).

PUNJAB: Jullundur, 21 Oct. 1874, *Clarke 23371* (K, glabrous). Palampur, 1,200 m., 26 Sept. 1896, *Duthie 18739* (K). Kulu Valley, 1,500 m., 12 Oct. 188–, *Collett* (K). Banjar, 27 July 1888, *Drummond* (K). Without definite locality, *Drummond 24428* (G; K, glabrous), *24429* (G), *24479* (K).

UTTAR PRADESH: *Tehri Garhwal:* Ganga Valley, 900–1,200 m., Sept. 1881, *Duthie 1614* (BM). *Kumaun:* Naini Tal, 2,000 m., *Strachey & Winterbottom 10* (K); *Madden* (K). Almora, 1,500 m., *Strachey & Winterbottom 14* (K). Niti, 3,500 m., *Strachey & Winterbottom 3* (BM; K). Below Chafi, 1,200 m., 17 Oct. 1885, *Reid* (E). Kumaun, *Blinkworth* in *Wallich 6329B* (K, *E. laetum*).

NEPAL: Tibrikot, Thuli Bheri River, 2,100 m., 12 Sept. 1952, *Polunin, Sykes & Williams 3336* (BM). Masem, near Tansing, 900 m., 9 Oct. 1954, *Stainton, Sykes & Williams 8859* (BM, glabrous).

UNPLACED LOCALITIES: India, *Jacquemont 1304* (K). Horticultural Society garden, Oct. 1839, *Royle* (garden progeny, K).

E. hirsutum, a widespread Eurasian species, has not yet been collected in the Himalaya between central Nepal and western China. It is extremely variable in degree of pubescence, but this variability does not, for the most part, appear to be geographically correlated, and the white-tomentose plants which are found more or less throughout the range of the species do not appear to me to require formal taxonomic recognition. A more significantly distinct series of populations is perhaps that which has been called *E. hirsutum* var. *laetum* C. B. Clarke. These relatively glabrous plants have been collected only in the Western Himalaya, but the more usual pubescent sort of plant is also frequent throughout that region (cf. notations in list of cited specimens).

5. **Epilobium parviflorum** Schreb., Spicil. Fl. Lips.: 146, 155 (1771).—C. B. Clarke in Hook. f., Fl. Brit. Ind. ii: 584 (1879).—Hausskn., Monogr. Epil.: 66, t. 1 fig. 21 (1884).—H. Lév., Ic. Gen. Epil.: t. 232 (1911).—Steinb. in Fl. URSS xv: 580 (1949).—Ross-Craig, Drawings Brit. Pl. xi: t. 19 (1958). [Type from Europe.]

Epilobium vestitum Benth. ex Wall., Numer. List: 216, n. 6327 (1832), ***nom. nud.***
Epilobium parviflorum var. *vestitum* C. B. Clarke, loc. cit. (1879).

Geographical range: Europe to western China; north Africa.

JAMMU AND KASHMIR: *Gilgit:* Gilgit, 1,500 m., 3 Aug. 1954, *Stewart 26470* (BM); 1,450 m., 13 July 1960, *Polunin 6018* (BM); 15 July 1960, *Polunin 6042* (BM). *Kashmir:* Uri, Jhelum Valley road, 1,200 m., 6 Sept. 1927, *Stewart 9482* (K). Sharda, 2,000 m., 1–10 Aug. 1953, *Schmid 572* (G). Tangmarg, 1,800 m., 16 Aug. 1956, *Polunin*

56/307 (BM). Gandarbal, 1,500 m., 21 July 1902, *Drummond 14383* (K); 27 Aug. 1917, *Stewart 3371½* (K).

HIMACHAL PRADESH: Simla, 1885, *Drummond 24425* (K). Luiahi, 2,400 m., Oct. 1885, *Collett 842* (K). Sutlej Valley near Rampur, 11 Aug. 1847, *Thomson* (G; K).

UTTAR PRADESH: *Kumaun:* Near Joshimath, 1,500–2,100 m., 1844, *Edgeworth 16* (K).

NEPAL: Sheopuri Hill, near Rivulet Rocks, north of Katmandu, 1821, *Wallich 6327* (BM; K, *E. vestitum*, and type of *E. parviflorum* var. *vestitum*).

Like *E. hirsutum*, this species has not been collected in the Himalaya east of central Nepal, although it is found not infrequently in western China. It appears to be much less common in the Western Himalaya than it is in the Near East, and thus has a pattern of distribution that is comparable in these regions to that of *E. minutiflorum*.

Schreber (Spicil. Fl. Lips.: 146) apparently lists this species in the body of his text as a *Chamaenerion* because he was there following, as closely as possible, the nomenclature of Boehmer (Fl. Lips. Indig. (1750)), who used the name *Chamaenerion* in place of *Epilobium*. The fact that Schreber intended that his epithets be known under the Linnaean system as species of *Epilobium* is indicated by his references to other species as *Epilobium* (Spicil. Fl. Lips.: 146–148 (1762)) and by his conspectus according to the Linnaean system (op. cit.: 155).

6. **Epilobium staintonii** Raven, sp. nov. (Plate 33 A.)

Herba perennis; rhizoma elongatum, squamis nullis; caulis 50–75 cm. altus, simplex, stramineus, pilis longis laxis vestitus, lineis prominulis elevatis e petiolorum marginibus decurrentibus notatus. *Folia* plerumque opposita sed superiora alterna, omnia subsessilia, lanceolato-linearia, apice anguste acuta, margine leviter remoteque serrulata, basi anguste cuneata, 3–4 cm. longa, 0·6–0·8 cm. lata, internodiis paulo breviora, utrinque ad nervos marginemque pubescentia, verisimiliter subglauca. *Inflorescentia* ante anthesin verisimiliter subnutans, glanduloso-pubescens, interdum pilis longioribus laxis mixtis. *Flores* 7–9 mm. longi. *Hypanthium* late infundibuliforme. *Sepala* c. 4 mm. longa, anguste acuminata. *Petala* roseo-purpurea, obcordata, 6–7 mm. longa. *Ovarii* stylus c. 4 mm. longus; stigma clavatum, 2 mm. longum, apice manifeste quadrilobatum, antheris staminum longiorum anthesi circumdatum. *Capsula* immatura ad 3·2 cm. longa, pilis longis laxis vestita, interdum glanduloso-pubescens; pedicellus ad 2·7 cm. longus. *Semina* adhuc ignota.

Geographical range: known only from the type locality in central Nepal.

NEPAL: Pura, near Muktinath (approximately 28° 49′ N., 83° 53′ E.), 3,650 m.; at edge of field; 29 July 1954, *Stainton, Sykes & Williams 2089* (BM, holotype).

E. staintonii, known only from the type collection, is unusual in its strict habit and investiture of long, lax hairs, as well as in its broadly four-lobed stigma. It does not appear to be closely related to any known species, but in its peculiar habit and leaves, as well as in its long-pedicellate capsules, it is reminiscent of *E. blinii* H. Lév. (*E. forrestii* Diels), a remarkable endemic of Yunnan. *E. blinii*, however, differs from the proposed new species in a host of characters, among them its pubescent stigma and much longer style, but, none the less, the relationship between the two serves to underscore the similarity between the floras of Nepal and of western China, which has been commented on by several authors, most recently by Stearn (in Bull. Brit. Mus. (Nat. Hist.), Bot. ii : 161–191 (1960)).

This species is named in honour of John D. A. Stainton, who collected in Nepal in 1954 (with Sykes and Williams) and 1956, and in Chitral in 1958.

7. **Epilobium cylindricum** D. Don, Prodr. Fl. Nepal. : 222 (1825).—Wall., Numer. List : 216, n. 6328 (1832).—Hausskn., Monogr. Epil. : 200 (1884).—H. Lév., Ic. Gen. Epil. : t. 69 (1910).

Epilobium roseum var. *cylindricum* (D. Don) C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 585 (1879).

Epilobium beauverdianum H. Lév. in Fedde, Repert. Sp. Nov. viii : 138 (1910) ; Ic. Gen. Epil. : t. 82 (1910). [Type : Kangting (" Ta-Tsien-lou "), Szechwan, 1893, *Soulié 449* (G).]

Epilobium christii H. Lév. in Fedde, op. cit. ix : 19 (1910) ; Ic. Gen. Epil. : t. 72 (1910). [Type from " Himalaya " (G, not found).]

Epilobium tianschanicum Pavlov in Wiss. Ber. Mosk. Staatsuniv. ii : 327 (1934).— Steinb. in Fl. URSS xv : 591 (1949). [Type : on banks near water, River Topchak-su, Khr. Talasskiy-Alatau, Tien Shan range, Russian Turkistan, 19 July 1931, *Pavlov 622* (Herb. Moscow Univ., holotype, not seen ; LE).]

Geographical range : north-eastern Afghanistan to the Tien Shan range and throughout the Himalaya to Szechwan, Yunnan and Hupeh.

WEST PAKISTAN *: Chitral :* Kalash region, upper Brumboret Valley at Brumotul, 2,000 m., 5 Oct. 1935, *Kerstan S255*, cultivated at Müncheberg in 1936 and 1937 (W). *Peshawar :* Pre Ghal, Suleiman Mountains, Waziristan, 1927, *Hay* (BM).

JAMMU AND KASHMIR : *Gilgit :* Rutton Pir, 2,100 m., 4 July 1876, *Clarke 28287* (BM). *Baltistan :* Hispar Valley, 2,750–3,050 m., 15 July 1939, *Scott Russell 1171* (BM). *Kashmir :* Gulmarg, 3,050 m., Sept. 1922, *Barbour* (BM). Above Gulmarg, 3,050 m., July 1929, *Stewart 10353* (G ; K). Ferozepur Nullah, near Gulmarg, 2,300 m., 2 Sept. 1929, *Stewart 10577a* (K). Fras Nag, 2,750 m., 25 July 1947, *Stewart 23189* (K). Kanzalwain, 2,300 m., 21 July 1876, *Clarke 29393* (BM). Manasbal, Aug. 1880, *Young* (BM). Near Islamabad, *Fuller 888* (K). Gagangir to Sonamarg, Sept. 1880, *Young* (BM). Banihal Pass, 2,100–2,750 m., 1931, *Stewart 13128* (K). Pahlgam, 2,300 m., 21 June 1920, *Stewart 5383* (K) ; 2,450 m., 20 Aug. 1920, *Stewart 5773* (K) ; 2,200 m., 29 Aug. 1925, *Stewart 8358* (G ; K) ; 2,450 m., 31 July 1945, *Stewart 21538* (K). Armium Glen, Liddar Valley, 2,750 m., Aug. 1925, *Stewart 9358a* (K). Liddar Valley, 2,450 m., 3 Aug. 1893, *Duthie 13460* (W). Upper Chenab Valley, 3,050 m., 6 June 1879, *Ellis* (K). Dal, *Young* (BM).

HIMACHAL PRADESH : Alwas, 2,100–2,400 m., 29 Aug. 1896, *Gammie 18319* (K). Dalhousie, 2,100 m., 13 Sept. 1874, *Clarke 22329* (BM) ; 1,500 m., 20 Sept. 1874, *Clarke 22828* (BM). Simla, 1885, *Drummond 24424* (K), *24804* (K) ; 1,500 m., 7 Sept. 1886, *Collett 146* (K). Near Simla, 7–20 Sept. 1864, *Stolitzka* (W). Below Simla, 1,800–2,100 m., 1844, *Edgeworth* (K). Jani Valley, Simla, 1,500 m., 7 July 1877, " *4624*A " (K).

PUNJAB: Nagar, Kulu, 1,500 m., 27 June 1916, *Cooper 5068* (E). Rahla to Manali, Kulu, 21 July 1888, *Drummond 22990* (K). Gundla, Lahul, 3,300 m., 8 Aug. 1916, *Cooper 5328* (E). Without definite locality, *Drummond 24805* (BM).

UTTAR PRADESH: *Tehri Garhwal:* Mussooree, 2,000 m., 1844, *Edgeworth* (K). Ganga Valley, 1,500–1,800 m., Sept. 1881, *Duthie 1617* (W). Gangotri, 3,650–3,950 m., Oct. 1881, *Duthie 1617* (BM; W). *Kumaun:* Naini Tal, 2,000 m., *Strachey & Winterbottom 8* (BM; K). Kumaun, 2,100 m., *Strachey & Winterbottom 13* (BM).

WEST BENGAL: Darjeeling, 2,600 m., 3 Sept. 1875, *Clarke 27274* (K). Mongpo, 1,400 m., 6 Oct. 1886, *Clarke 36290* (G).

S.E. TIBET: Nomaysamdong, 4,250 m., 6 Sept. 1911, *Ribu & Rohmoo* (G). Vicinity of Lhasa, June 1939, *Richardson 193a* (BM). Reting, 60 miles north of Lhasa, 4,250 m., 21 July 1942, *Ludlow & Sherriff 8851* (BM). Gyamda Chu, Puchu, Kongbo, 2,900 m., 10 Aug. 1938, *Ludlow, Sherriff & Taylor 6803* (BM). Tongkyuk, 2,750 m., 31 July 1935, *Kingdon-Ward 12103* (BM). Deyang La, Kongbo, 3,650 m., 8 Aug. 1947, *Ludlow, Sherriff & Elliot 14248* (BM).

NEPAL: Gurjakhani, 2,600 m., 19 July 1954, *Stainton, Sykes & Williams 3552* (BM). Maharang, south of Mustang, 4,250 m., 13 Aug. 1954, *Stainton, Sykes & Williams 7206* (BM). Between Lho and Suma, 3,350 m., 4 July 1953, *Gardner 1114* (BM). Langtang forest area, 2,900 m., 1 Aug. 1949, *Polunin 1615* (BM). Langtang village area, 3,500 m., 1 Aug. 1949, *Polunin 1520* (BM). Gurjang, 2,400–2,750 m., 1930, *Lall Dhwoj 0525* (BM). Sheopuri Hill, north of Katmandu, Aug. 1821, *Wallich 6328* (BM, lectotype; E; G; K; W).

SIKKIM: Lachen, 2,750–3,050 m., 3 Aug. 1849, *Hooker* (K). Without definite locality, *Cave 989* (BM); 2,100–3,050 m., *Hooker* (BM; G; K).

BHUTAN: Thimbu, 2,400 m., 8 Oct. 1914, *Cooper 2940* (BM; E).

E. cylindricum is a very characteristic species of the Sino-Himalayan area, and the commonest of a group that also includes *E. tibetanum*, *E. leiospermum* and the somewhat more distantly related *E. sinense* H. Lév. of western China. The relationships between *E. cylindricum* and the first two species, which occur in the central and western portions of the Himalaya, need to be studied in much greater detail. A proper understanding of the group will depend on the collection of more specimens with ripe seeds and adequate portions of the underground parts. A collection from Kashmir (above Gulmarg, 3,050 m., 21 Aug. 1929, *Stewart 10509* (K)) with large apparently white petals that is close to *E. cylindricum* in aspect but appears not to be setting good fruit may be a hybrid involving this and some other species. *E. royleanum* also is closely related to *E. cylindricum*, and certain relatively narrow-leaved plants from the western parts of its range are separable only with difficulty from the latter species. *E. royleanum*, however, usually has a distinctly capitate stigma.

It is uncertain whether the actual specimen of this species that David Don studied in the Lambert Herbarium is still extant, but there are numerous identical specimens in various herbaria bearing the same number. The specimen that I have selected as the type is labelled " India Wallich 6328 ", and could possibly have come from the Lambert Herbarium; the three sheets now in the herbarium at Kew were probably all held by the East India Company at the time that David Don was making his studies of Nepal plants.

8. **Epilobium tibetanum** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 53 (1879) ; Monogr. Epil. : 201 (1884).—H. Lév., Ic. Gen. Epil. : t. 75 (1910).

Epilobium tetragonum sensu Aitch. in Journ. Linn. Soc. Lond., Bot. xviii : 60 (1880) pro parte; non L.
Epilobium cylindricum sensu Wendelbo in Nytt Mag. Bot. i : 46 (1952) ; non D. Don.
Epilobium royleanum sensu Wendelbo, loc. cit. (1952) ; non Hausskn.
Epilobium nuristanicum Rech. f. in Biol. Skr. Dansk. Vid. Selsk. x, 3 : 61 (1958). [Type : wet meadow above Paschki in Parun Valley, Nuristan, Afghanistan, 2 Aug. 1935, *Kerstan 1382* (W).]

Geographical range : north-eastern Afghanistan (Nuristan) to Baltistan in the Western Himalaya.

West Pakistan : *Chitral :* Shandur Pass, south-east of Mastuj, 3,650 m., 9 Aug. 1958, *Stainton 3084* (BM ; W). Upper Brumboret Valley, near Kalash, 2,000 m., 5 Oct. 1935, *Kerstan 2092* (W). Main Barum Glacier, 3,200 m., 20 July 1950, *Wendelbo* (BM ; K). Above Shokor Shal, 3,600 m., 23 July 1950, *Wendelbo* (BM ; K). Golen Gol, 3,050 m., 13 July 1958, *Bowes Lyon 64* in part (BM ; W). Arkari Gol, west of Tirich Mir, 2,400 m., 12 June 1958, *Stainton 2650* (BM ; W). *Peshawar :* Shend Toi, Kurram Valley, 27 Aug. 1879, *Aitchison 1151* (K). Shalizan, Kurram Valley, 1879, *Aitchison 651* (BM in part ; G). About Ushu, 2,400 m., 26 July 1953, *Stewart & Rahman 25390* (BM). Kagan Valley between Balakot and Babusar Pass, July–Sept. 1954, *Abel 67* (BM).

Jammu and Kashmir : *Baltistan :* Satpura Village, 3,050 m., 4 Aug. 1955, *Webster & Nasir 6329* (K ; W). Kushuchun Lungmo Valley, 2,900–3,200 m., 29 Aug. 1939, *Scott Russell 1777* (BM). Thale La to Bagmaharal, 30 Aug. 1856, *Schlagintweit 5909* (JE, holotype).

Although the type of this species has flowers about 8 mm. long, which is at the upper limit of variation in flower size, I can find no other consistent character that distinguishes it from the recently described *E. nuristanicum.* It is very difficult to distinguish from *E. cylindricum* in the absence of mature seeds, but has a more distinctly clavate stigma, for the most part. Moreover, the line of demarcation between *E. tibetanum* and *E. leiospermum* will need to be reconsidered when more material is available.

9. **Epilobium leiospermum** Hausskn., Monogr. Epil. : 206, t. 5 fig. 45 (1884).—H. Lév., Ic. Gen. Epil. : t. 65 (1910).

Geographical range : Himalaya from the Murree Hills to western Nepal and extending to the Chumbi Valley and the vicinity of Lhasa, Tibet.

West Pakistan : *Peshawar :* Nathia Gali, *Deane* (K).

Jammu and Kashmir : *Gilgit :* " Shanhar Gunh ", 2,750 m., *Giles 646* (K). Gilgit to Imit, 1,620–2,580 m., 28 July 1954, *Schmid 2006* (G). *Baltistan :* Near Tashing, north-west of Astor, 10–24 Sept. 1856, *Schlagintweit* (JE, lectotype). *Kashmir :* Shupiyan, 2,100 m., 9 July 1876, *Clarke 28561* (K). Burzil Pass, 3,350 m., 28 July 1876, *Clarke 29714* (BM ; K). Sonamarg, 2,750 m., 15 Aug. 1928, *Stewart 9873* (G ; K). Kilar, 2,400 m., 1879, *Baden-Powell 168* (K). Ajog Valley, 3,350 m., 29 June 1881, *Ellis 1427* (K).

HIMACHAL PRADESH : Pangi, Sanch Valley, Chamba, 3,650 m., 17 Aug. 1899, *Duthie* (K).

PUNJAB : Kardang, Lahul, 3,100 m., 7 July 1941, *Bor 14005* (K). Sisu, Lahul, 3,200 m., 6 July 1938, *Bor 12408* (K) ; 8 July 1941, *Bor 10287* (K).

UTTAR PRADESH : *Kumaun :* Kuwari Benaik, 3,050 m., *Strachey & Winterbottom 9* (K). Muklia road, 10 July 1883, *Duthie 1047* (G).

S.E. TIBET : Gum-boteen, 600 m. above Chumbi, 18 July 1878, *Dungboo* (BM ; K). Hills west of Lhasa, beyond Trisum, 4,100 m., 1 Sept. 1942, *Ludlow & Sherriff 9040* (BM).

NEPAL : Yangar, 7 Aug. 1936, *Bailey* (E) . Near Tarakot, Bheri River, 2,750 m., 15 July 1952, *Polunin, Sykes & Williams 2471* (BM).

The plants grouped here as *E. leiospermum* are variable in the width of their leaves but none the less appear to form a coherent group that is distinct from *E. cylindricum* and from *E. tibetanum*. Nevertheless, as noted under *E. cylindricum*, more complete specimens and preferably garden or field observations will be necessary before the status of these plants can be considered well understood.

10. **Epilobium indicum** Hausskn., Monogr. Epil. : 199, t. 6 fig. 46 (1884).

Geographical range : uncertain ; said to be Nepal.

UNCERTAIN LOCALITY : " Sem. ex Ind. Nepal. colui", 1881, *Haussknecht* (JE, lectotype).

I have seen no material of this remarkable species except the type and a series of collections that were made by Haussknecht from the same cultivated material at the same time (all JE). H. Léveillé's figure (Ic. Gen. Epil. : t. 94 (1910)) probably does not represent this species. As was remarked in the original place of publication, *E. indicum* is strikingly similar to the Eurasian *E. roseum* Schreb., but it differs in several peculiarities, not the least of which are its much larger, probably exogamous flowers with the cylindric stigma elevated well above the anthers at anthesis. When and how Haussknecht obtained the seeds is a mystery, particularly in view of the fact that the most recent botanical visitor to Nepal had been J. D. Hooker some thirty years earlier, and one is led to wonder if they did in fact come from Nepal. Nevertheless, I am unable to match *E. indicum* with any other known Eurasian species, and its status must remain in great doubt until it is re-collected.

11. **Epilobium royleanum** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 55 (1879) ; Monogr. Epil. : 205 (1884).—H. Lév., Ic. Gen. Epil. : t. 66 (1910).

? *Epilobium roseum* var. *indicum* C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 584 (1879). [No authentic material seen, but probably belongs here.]

Epilobium roseum var. *dalhousieanum* C. B. Clarke, loc. cit. (1879).

Epilobium lividum Hausskn., op. cit. : 201, t. 7 fig. 49 (1884).—H. Lév., op. cit. : t. 73 (1910).

Epilobium himalayense Hausskn., op. cit. : 213, t. 7 fig. 48 (1884).—? H. Lév., op. cit. : t. 108 (1910) (forsan *E. brevifolium* subsp. *brevifolium*).

Geographical range : north-eastern Afghanistan (Nuristan) through the Himalaya to Yunnan ; rare in the east.

WEST PAKISTAN: *Chitral:* Birir, 1,500 m., 27 July 1954, *Siddiqui & Rahman 26775* (BM). Laspur, 2,900 m., 24 July 1958, *Bowes Lyon 101* (BM; W). Wasam, Mastuj-Baroghil track, 2,750 m., 20 July 1958, *Stainton 2942* (BM; W). *Peshawar:* Jiran Tangi, Kurram Valley, 5 Oct. 1894, *Harsukh 15323* (K). Sho Nullah, 2,100–2,400 m., 21 Aug. 1955, *Rahman 114* (BM); 2,750 m., 23 Aug. 1955, *Rahman 117* (BM). Mount Ilam, 1,800–2,400 m., 12 Aug. 1952, *Stewart 24361* (BM). Kulali, *c.* 7 miles up Swat River from Baranial, 1,700 m., 18 Aug. 1952, *Rodin 5602* (K). Ushu to Baranial, 2,400–2,750 m., 27 July 1953, *Stewart & Rahman 25306* (BM). Thandiani, 2,400–2,750 m., 13 Aug. 1956, *Stewart 27756* (BM); 3 Aug. 1956, *Stewart 27758* (BM). Changa to Dunga Gali, Murree Hills, 2,400 m., Aug. 1949, *Stewart 23457* (K). Changla Gail, Murree Hills, 2,100–2,400 m., 27 Aug. 1918, *Stewart 3931* (K). Murree, 2,000–2,100 m., 18 Aug. 1949, *Stewart 23458* (K); Aug. 1880, *Young* (BM); 2,100 m., 4 Oct. 1924, *Stewart 7768* (K). Kagan Valley between Balakot and Babusar Pass, July–Sept. 1954, *Abel 68* (BM).

JAMMU AND KASHMIR: *Gilgit:* Gilgit to Imit, 1,620–2,580 m., 28 July 1954, *Schmid 2037* (G). Gurikot to Das Kirim, Astor, 29 July 1946, *Stewart 22968* (K). Imit, 2,900 m., 2–3 Aug. 1954, *Schmid 2078* (G). Shan Kagarh to Rattu, Astor, 2,750 m., July 1946, *Stewart 22785* (K). *Baltistan:* Hispar village area, 3,200 m., 20 Aug. 1960, *Polunin 6355* (BM). Nagar village area, 2,350 m., 28 Aug. 1960, *Polunin 6420* (BM). Skardu, 2,100–2,300 m., 6 Aug.–4 Sept. 1856, *Schlagintweit* (BM). *Ladakh:* Panamik to Sanglung, Nubra Valley, *Schlagintweit* (BM). Nubra Valley, 28 July 1848, *Thomson* (K). Ravine below Gya, 28 Sept. 1847, *Thomson* (K). *Hunza:* Chalt, 1,800 m., 10 Sept. 1960, *Polunin 6458* (BM). *Kashmir:* Tangmarg, near Gulmarg, 2,300 m., July 1929, *Stewart 10608* (K). Above Gulmarg, 3,350 m., 5 July 1929, *Stewart 10636* (K). Ningle Nullah, 2,750 m., 15 July 1940, *Pinfold 203* (BM). Gulmarg, 2,600 m., 20 Aug. 1919, *Rich 30* (K). Near Ronda, 16 Sept. 1917, *Rich 709* (K). Sonamarg, 3,050 m., 23 July 1928, *Stewart 9773* (K). Pahlgam, 2,200 m., Aug. 1927, *Stewart 13129* (K); 2,100 m., 3 Sept. 1925, *Stewart 8451* (K); 2,750 m., 30 July 1927, *Stewart 9239a* (K); 5 Sept. 1876, *Clarke 31093* (K). Baltal, 2,900 m., 6 July 1919, *Rich 1127* (K). "Kootihar Valley", 26 Nov. 1896, *Johnston 19* (E). Forest near Kahi Galli, 2,400–2,750 m., 5 Oct. 1888, *Duthie 7479* (BM; K).

HIMACHAL PRADESH: Ascent to Werang Pap, Kanawar, 19 Aug. 1857, *Thomson* (K, lectotype of *E. himalayense*). Dalhousie, 2,100 m., 11 Sept. 1874, *Clarke 22190* (K, lectotype of *E. roseum* var. *dalhousieanum*); 23 Sept. 1874, *Clarke 22978* (BM); 1879–80, *Drummond 24807* (K), *24808* (K), *24810* (K). Simla, 2,100 m., 15 Aug. 1886, *Collett 352* (K); 1,800–2,400 m., July 1849, *Thomson* (K); 1887, *Drummond 20820* (E); 25 July 1831, *Dalhousie* (K); 2,300 m., 26 Sept. 1918, *Rich 140* (K); 2,100–2,400 m., July 1849, *Thomson* (K); 1,500–2,400 m., 1884, *Edgeworth 15* (K). Mahasu, Simla, 2,400 m., Oct. 1878, *Gamble 6594A* (K). Matiani, Simla, 2,450 m., July 1885, *Collett* (K). Near Sirgul, towards Mt. Chor, Simla, 3,050 m., 27 Sept. 1884, *Drummond 1584* (K). Upper part of Hatugarh, Simla, 5 Aug. 1847, *Thomson 1723* (K). Mt. Chor, Simla, *Drummond 24427* (K); 2,400 m., *Drummond* (K).

PUNJAB: Above Dahar, Kulu, 7 July 1888, *Drummond 22992* (K). Kyelang, Lahul, 6 July 1888, *Drummond 22991* (K); 3,200 m., 30 June 1941, *Bor 16947* (K). Rohtang, Lahul, 3,350 m., 1 July 1938, *Bor 12091* (K). Jibhi to Kot, Kulu, 28 July

1888, *Drummond 22989* (E). Without definite locality, *Drummond 20031* (E ; K), *24430* (G ; K).

UTTAR PRADESH : *Tehri Garhwal :* Ganga Valley above Derali, 3,050–3,350 m., 7 Aug. 1883, *Duthie 1045* (G). *Kumaun :* Seed from near Deoband, 2,400 m., *Duthie*, the plants grown at Kew and collected 30 June 1880, *Nicholson* (JE, holotype of *E. lividum*). Milam, 3,800 m., *Strachey & Winterbottom 12* in part (K).

S.E. TIBET : Drukla Gompa, Sibu Chu, Kongbo, 3,350 m., 28 July 1947, *Ludlow, Sherriff & Elliot 15516* (BM). Tibet, 28° 25′ N., 97° 55′ E., 3,350–3,650 m., 1930–1931, *Kingdon-Ward 10034* (BM).

NEPAL : Beding to Nongaon, 3,650 m., 20 Sept. 1954, *Zimmermann 1394* (G).

SIKKIM : Mountains, 1,800–2,400 m., *Hooker* (G ; K).

ASSAM : Khasi Hills, 1,500–2,750 m., 15 Aug. 1847, *Thomson* (K).

UNPLACED LOCALITY : North-west India, *Royle* (K, lectotype).

E. royleanum is apparently one of the commonest species of the genus in the Western Himalaya, but it is very difficult to explain why there is only a scattering of records from Nepal to western China. These eastern plants seem to be indistinguishable morphologically from the rest. This species is variable in stature and in its underground parts, which sometimes are bare and at other times have a small tuft of scales at the summit of the root crown. This may, however, depend on age, the younger plants lacking scales. A single collection from Tehri Garhwal (Rudugaira Gad, 4,550 m., 23 Sept. 1952, *Huggins H233* (BM)) resembles *E. royleanum* but has a turioniferous base similar to that of *E. glaciale*. It is probably distinct, but ripe seeds would be necessary to determine its correct taxonomic position. Haussknecht (Monogr. Epil. : 206) believed that *E. royleanum* hybridizes with *E. brevifolium* subsp. *brevifolium* in the areas where they come into contact, but I have referred all such plants to *E. royleanum*, considering that although they have somewhat broader leaves they fall within what appears to me to be a reasonable range of variability. Furthermore, they are fully fertile, judging from their apparent seed set and from examination of their pollen. Field observations on the relationship between these two species, however, are much to be desired.

I am unable at present to maintain as specifically distinct those plants that Haussknecht called *E. himalayense*, although in my view he included several diverse elements in this taxon. These plants have a lower stature than is usual for *E. royleanum* but do not seem to differ otherwise, although Haussknecht placed them in his group with acuminate seeds, whereas he placed *E. royleanum* in the group with obovoid seeds. The status of *E. lividum* is even more doubtful, but I have seen only the single specimen that was studied by Haussknecht, and am unable on the basis of that one specimen to accord the taxon specific rank at present. With its narrow leaves, and especially its glabrescent lower stem, the plant approaches *E. cylindricum*. Nevertheless it is probably best referred to the synonymy ot *E. royleanum*, at least for the present. The illustration given by Haussknecht, cited above, is a very good representation of the type collection.

Two forms may be distinguished from the type :

EPILOBIUM ROYLEANUM forma GLANDULOSUM Raven, forma nov.

A typo differt caulium et inflorescentiarum pilis glandulosis, non strigosis.

Jammu and Kashmir: *Gilgit:* Manu Gam Nullah, 3,200 m., 31 Aug. 1950, *Thornley 26* (BM). Naltar Valley, 1,800–2,100 m., 3 Aug. 1892, *Duthie 12351* (K). Naltar to Nomal, 2,400 m., 24 July 1954, *Stewart* (BM). *Baltistan:* Hispar Glacier snout, 3,200 m.; growing by spring, damp ground; 21 Aug. 1960, *Polunin 6362* (BM, holotype).

These plants constitute a very distinct local assemblage within *E. royleanum*, since the pubescence of their stems and inflorescence consists of long glandular, not strigose, hairs. When the form was grown side by side with typical *E. royleanum* at Claremont, California, however, no other difference was noted.

Epilobium royleanum forma glabrum Raven, forma nov.

A typo differt caulibus lineis distinctis pilosis praeditis.

Jammu and Kashmir: *Baltistan:* Kushuchun Lungmo Valley, 2,900–3,200 m., 29 Aug. 1939, *Scott Russell 1777a* (BM). *Ladakh:* Nubra Valley, 28 July 1848, *Thomson* (K). Kharchar, 23 July 1848, *Thomson* (K). *Kashmir:* Sonamarg, 3,050 m., 20 Aug. 1946, *Stewart 22395* (K). Pahlgam (approximately 34° 02′ N., 75° 20′ E.), 2,450 m., 31 July 1945, *Stewart 21523* (K, holotype); 2,100 m., 29 July 1920, *Stewart 5507* (K). Sorus, Pahlgam, 3,350 m., 27 July 1925, *Stewart 8068* (K). Armium Glen, Liddar Valley, 2,750 m., Aug. 1925, *Stewart 22395* (K). Arunth to Sach Pass, 3,650 m., *Ellis 1649* in part (K).

Himachal Pradesh: Simla, 1885, *Drummond 24423*A (K).

Punjab: Darcha, Lahul, 3,350 m., 4 July 1941, *Bor 3177* in part (K).

These plants apparently differ from the typical form only in the distribution of their pubescence, but nevertheless are strikingly different in this respect. I have therefore accorded them formal taxonomic recognition in order to call special attention to them, and in the hope that they may be studied further, especially in the field.

12. **Epilobium brevifolium** D. Don, Prodr. Fl. Nepal.: 222 (1825).—Haussk., Monogr. Epil.: 207 (1884).—H. Lév., Ic. Epil.: t. 90 (1910).

Geographical range: Himachal Pradesh in the Western Himalaya eastwards throughout the Range and southern China to Formosa, northern Luzon, North Vietnam and Burma.

12*a*. **Epilobium brevifolium** subsp. **brevifolium.**

Epilobium trichoneurum var. *brachyphyllum* Hausskn. in Oesterr. Bot. Zeitschr. xxix: 54 (1879).

Geographical range: Himalaya from Himachal Pradesh to central Nepal.

Himachal Pradesh: Dalhousie, 1879–1880, *Drummond 24806* (K). Simla, 25 July 1831, *Dalhousie* (G; K); 17 Sept. (1831 ?), *Dalhousie* (G); 1,800–2,450 m., July 1849, *Thomson* (K); 1,800 m., 15 Aug. 1877, *Gamble 4731*A (K); 2,100 m., 20 Aug. 1886, *Collett 384* (K); *Madden* (K); *Simpson* (K). Theog Hill, Simla, 2,300 m., 8 Sept. 1878, *Gamble 6506* (K); 1,800 m., 30 Aug. 1884, *Drummond 1579* (K). Chadwick Falls, Simla, 1,750 m., 9 Sept. 1884, *Drummond 1578* (K). Jako, Simla, 19 Sept. 1915, *Rich 30* (K). Ascent to Runang Pap, Kanawar, 21 Aug. 1847, *Thomson* (K).

PUNJAB: Lahul, *Jaeschke 100a* (K). Deoban, Jaunsar District, 2,450 m., Oct. 1894, *Gamble 25218* (K). Jaunsar District above Kalsi, 2,100 m., Oct. 1894, *Gamble 25196* (K).

UTTAR PRADESH: *Tehri Garhwal:* Dhanaulti, Tehri road beyond Mussooree, 2,100 m., 26 Aug. 1944, *Stewart 21185* (K). Mussooree, *Hügel 404* (W). Scandal Point, Mussooree, 1,900 m., Sept. 1919, *Anderson 39* (E). *Kumaun:* Naini Tal, 2,100 m., *Strachey & Winterbottom 13* (K). Barji Kang Pass, 4,400 m., *Strachey & Winterbottom 7* (K). Kumaun, *Blinkworth* (K).

NEPAL: Khorlak, 3,650–3,950 m., 1929, *Lall Dhwoj 22* (BM). Syarpagoan, 2,900 m., 23–31 Aug. 1949, *Polunin 1859* (BM). Langdan Tati, 1,500 m., 29 Aug. 1935, *Bailey's collectors* (BM).

UNPLACED LOCALITIES: North-west Himalaya, 1,800–2,400 m., *Thomson* (K, lectotype of *E. trichoneurum* var. *brachyphyllum*). North-west India, *Royle* (K).

There is no material of the type collection of this species (" in Nepaliâ superiore. *Hamilton*") in the herbaria of the British Museum (Natural History), Edinburgh, Kew, nor in the herbarium of Sir James E. Smith at the Linnean Society, London (cf. Stearn in Bull. Brit. Mus. (Nat.Hist.), Bot. ii: 180 (1960)). Therefore, in view of the extremely brief original description, we are largely dependent upon Haussknecht's interpretation of the species for the application of the name. There does not appear to be any valid reason, however, to upset traditional practice in this regard.

I have considered this taxon to be conspecific with *E. trichoneurum*, as was first done by Haussknecht in 1879, because the two entities replace one another geographically and their patterns of variation overlap broadly, plants from the Khasi Hills being especially variable with respect to leaf shape. The two subspecies differ consistently only in leaf shape, although the eastern plants (subsp. *trichoneurum*) as a rule have more clavate, not capitate, stigmas. A collection of subsp. *brevifolium* from Lahul (*Jaeschke 58* (K)) agrees with most of the collections of this entity except in the pubescence of its stems, which is in lines. It thus appears to have a relationship with subsp. *brevifolium* analogous to that of the relationship between *E. royleanum* forma *glabrum* and typical *E. royleanum*.

12*b*. **Epilobium brevifolium** subsp. **trichoneurum** (Hausskn.) Raven, stat. nov.

Epilobium trichoneurum Hausskn. in Oesterr. Bot. Zeitschr. xxix: 54 (Feb. 1879); Monogr. Epil.: 208 (1884).—H. Lév., Ic. Gen. Epil.: t. 84 (1910).

Epilobium hookeri C. B. Clarke in Hook. f., Fl. Brit. Ind. ii: 585 (May 1879).—Barbey, Epil.: t. 15 (1885).

Epilobium esquirolii H. Lév. in Bull. Herb. Boiss., Sér. 2, vii: 590 (1907); Ic. Gen. Epil.: t. 146 (1910). [Type: Kweichow, *Esquirol 607*, not seen.]

Epilobium cordouei H. Lév. in Fedde, Repert. Nov. Sp. vi: 110 (1908); Ic. Gen. Epil.: t. 87 (1910). [Type: Majo, Kweichow, 5 Sept. 1907, *Cavalerie 3151*, not seen.]

Epilobium philippinense C. B. Robinson in Philipp. Journ. Sci., Sect. C, iii: 209 (1908). [Type: Mt. Data, District of Lepanto, Luzon, 3 Nov. 1905, *Merrill 4484* (Herb. Bur. Sci., Manila, destroyed; K).]

Geographical range: south-eastern Tibet (Chumbi Valley) to Assam, Burma, western China and northern Luzon.

S.E. TIBET: Pheemong, near Chumbi, 15 July 1878, *Dungboo* (K).

BHUTAN : Rocha Chu Valley, Trashiyangtse, 2,400 m., 27 Sept. 1934, *Ludlow & Sherriff 987* (BM). Trashi Chö Dzong, Thimbu, 2,400 m., 11 Aug. 1914, *Cooper 3118* (E).

ASSAM : Near Orka La, 2,400 m., 24 Sept. 1938, *Kingdon-Ward 14280* (BM). Khasi Hills, 1,500–2,100 m., *Hooker & Thomson* (BM ; K, lectotype of *E. trichoneurum* and of *E. hookeri*). " Dingling " (Dingien ?), Khasi Hills, 1,500 m., 29 Nov. 1871, *Clarke 14806* (K). Nunklao, Khasi Hills, 1,500–2,100 m., 18 Oct. 1850, *Hooker & Thomson* (K) ; 1,350 m., 30 Oct. 1872, *Clarke 19302* (BM). Mairang, Khasi Hills, 1,200 m., 30 Oct. 1871, *Clarke 16086* (BM), *16116* (K). Cherrapunji, Khasi Hills, 1,500–2,100 m., 9 Sept. 1850, *Hooker & Thomson* (K). Kala Panee, Khasi Hills, 1,500 m., 14 Oct. 1872, *Clarke 19826* (E). Maoflang, Khasi Hills, 1,500–2,100 m., 30 July 1850, *Hooker & Thomson* (K) ; 1,750 m., 21 Aug. 1885, *Clarke 38961* (G) ; 3 Oct. 1886, *Clarke 44875* (BM) ; 1,350 m., 11 Aug. 1949, *Kingdon-Ward 18778* (BM). Pomrang, Khasi Hills, 16 Aug. 1885, *Clarke 38844* (G) ; 5 Sept. 1885, *Clarke 44599* (G). " Maokadokadok," Khasi Hills, 1,500 m., 13 Sept. 1885, *Clark 40391* (BM). " Lailankote," Khasi Hills, 1,700 m., *Clarke 45546* (G). But, 1,900 m., 21 Oct. 1955, *Rankin & Pretzlik 092* (BM). Bomdi La, 2,750 m., 18 Oct. 1955, *Rankin & Pretzlik 033* (BM). Delei Valley, 2,750 m., 28 Aug. 1929, *Kingdon-Ward 8606* (K). Kahao, 1,650 m., 9 July 1950, *Kingdon-Ward 20048* (BM). North Vanlaiphai, Lushai Hills, 1,500 m., 2 Nov. 1927, *Parry 362* (K).

MANIPUR : Lamaitak, 1,500 m., Oct. 1907, *Meebold 5969* (K). Longbi, 1,200–1,500 m., 10 Sept. 1948, *Kingdon-Ward 18080* (BM). Sirhoi, 2,100–2,600 m., 21 July 1948, *Kingdon-Ward 17840* (BM).

NAGA HILLS : Kohima, 1,200 m., 2 Oct. 1885, *Clarke 41560* (K). Pulebadze, 2,150 m., 4 Aug. 1935, *Bor 5308* (K). Japvo, 2,400 m., 25 Sept. 1935, *Bor 6634* (K).

BURMA : Esakan, Mount Victoria, 1,800 m., 2 Sept. 1956, *Kingdon-Ward 22632* (BM). Yedwintaung, Meiktila District, 1,050 m., 23 Oct. 1936, *Smith 16297* (K). Valley of the Nam Tamai, 1,200 m., 4 Sept. 1937, *Kingdon-Ward 13105* (BM).

UNPLACED LOCALITY : East Bengal, *Griffith 2227* (W).

Two additional collections from S.E. Tibet might be referable to this subspecies : Tuna to Dochen, 4,250 m., 7 Aug. 1936, *Chapman 626* (K) ; mountain behind Drepung, north-west of Lhasa, 5,600 m., 27 Sept. 1936, *Chapman 19* (K). Despite their superficial morphological resemblance, however, it is doubtful whether they belong here, since they are from much higher elevations and much more arid localities than those usual for subsp. *trichoneurum*.

12*c*. **Epilobium brevifolium** subsp. **pannosum** (Hausskn.) Raven, stat. nov.

Epilobium pannosum Hausskn. in Oesterr. Bot. Zeitschr. xxix : 54 (Feb. 1879) ; Monogr. Epil. : 209 (1884).—H. Lév., Ic. Gen. Epil. : t. 81 (1910).

Epilobium khasianum C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 585 (May 1879).—Barbey, Epil. : t. 16 (1885).

Geographical range : Assam, Burma, Yunnan and North Vietnam.

ASSAM : Below Pomrang, Khasi Hills, 1,500 m., 10 Sept. 1850, *Hooker & Thomson 2322* (K, lectotype of *E. pannosum* and of *E. khasianum*). Khasi Hills, 1,500 m., *Hooker & Thomson* (K). " Low valleys toward Nungtuy ", Khasi Hills, 900 m., *Griffith 2226* (K). "Pombara" (Pamora ?), Khasi Hills, 1,400 m., 14 Oct. 1867, *Clarke 5810* (K).

BURMA: Maymyo Plateau, 1,050 m., 5 Oct. 1908, *Lace 4273* (E; K). Shan Hills, Tamarkan District, 2,750 m., Nov. 1888, *Collett 931* (K).

This is a remarkable subspecies which has been collected most frequently in Yunnan. Its large cylindric stigma is elevated far above its anthers at anthesis and its corollas are very large, indicating that it is probably modally outcrossed. It occurs at low elevations in regions of high rainfall, and is very probably relict in nature. Although very distinct in its typical form, such collections as *Bor 6634* (*E. brevifolium* subsp. *trichoneurum* from the Naga Hills) and *Lace 4273* (from Burma) serve to connect subsp. *pannosum* with subsp. *trichoneurum*, being intermediate between these entities in pubescence and flower size. Hence, although these taxa are incompletely allopatric, recognition as subspecies appears to be most appropriate. The close relationship between them has been stressed both by Clarke and by Haussknecht. In both of them the buds are individually pendulous before anthesis, and observations on this characteristic in living material of subsp. *brevifolium* would be particularly welcome, since it is impossible to tell from the herbarium material at hand whether or not the buds of that subspecies are like those of the other two in this respect.

13. **Epilobium kermodei** Raven, sp. nov. (Plate 33 B.)

Herba perennis; caulis parte subterranea squamis nullis, supra terram 30–50 cm. altus, simplex, flavo-brunneus, pilosus, lineis elevatis e petiolorum marginibus decurrentibus praeditus, basi foliis brunneis coriaceis serrulatis sparse pilosis vestitus. *Folia* plerumque opposita, superiora alterna, omnia breviter petiolata, apice acuta, margine argute serrulata, basi late cuneata, 2·5–5 cm. longa, 0·7–1·7 cm. lata, internodiis subaequalia vel longiora, utrinque ad nervos marginemque dense, ceterum sparse, strigosa, flaccida. *Inflorescentia* ante anthesin verisimiliter subnutans, dense glanduloso-pubescens, interdum praesertim in ovariis pilis strigosis longioribus inter eos glandulosos mixtis. *Flores* c. 7 mm. longi. *Hypanthium* infundibuliforme. *Sepala* c. 5 mm. longa, acuta. *Petala* roseo-purpurea, obcordata, c. 6 mm. longa. *Ovarium* plerumque bractea multo longius; stylus c. 3·5 mm. longus; stigma capitatum, c. 1 mm. latum, antheris anthesi circumdatum. *Capsula* 7·5–9 cm. longa, sparse pilosa; pedicellus 1–2 cm. longus. *Semina* obovoidea, c. 1 mm. longa, papillosa, brunnea, coma alba copiosa c. 5 mm. longa coronata.

Geographical range: known only from the type locality in Upper Burma.

BURMA: Near Hpimaw, Myitkyina District (approximately 25° 24′ N., 97° 23′ E.), 2,100 m.; by roadside; 25 Apr. 1938, *Kermode 17233* (K, holotype).

This species, which is known only from the type collection, is so distinct in its pubescence and long capsules that it is difficult to determine what its close relatives may be. *E. brevifolium* (subsp. *pannosum* and subsp. *trichoneurum*), the only other species found in the same vicinity, has clavate stigmas and shorter capsules and is otherwise quite different from *E. kermodei*.

I have named this species in honour of Charles William Daly Kermode, lately

Professor of Forestry in the University of Rangoon, Burma, who in the course of his duties as a forester in Burma from 1924 onwards, successively as assistant conservator (1924), deputy conservator (1928), silviculturist (1935) and forest botanist, made large collections of specimens now in the Kew Herbarium.

14. **Epilobium wallichianum** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 54 (1879) ; Monogr. Epil. : 218, t. 8 fig. 52 (1884).—H. Lév., Ic. Gen. Epil. : t. 128 (1910).

Geographical range : western Nepal to Yunnan and Burma.

14*a*. **Epilobium wallichianum** subsp. **wallichianum.**

Epilobium nepalense Hausskn. in Oesterr. Bot. Zeitschr. xxix : 53 (1879) pro parte ; Monogr. Epil.: 218 (1884) pro parte.—H. Lév., Ic. Gen. Epil.: t. 120 (1910).

Epilobium tetragonum sensu C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 586 (1979) pro parte ; non L.

Epilobium duclouxii H. Lév. in Fedde, Repert. Nov. Sp. vi : 110 (1908) ; Ic. Gen. Epil. : t. 144 (1910). [Type : San-Chan near Tchen-Hiong, Yunnan, 19 Aug. 1905, *Mey 500*, not seen.]

Geographical range : western Nepal to Yunnan.

West Bengal : Darjeeling, 1904, *Drummond 21022* (K) ; 2,100 m., July 1876, *Gamble 825* (K). Kala Pokri, 3,050 m., 6 Oct. 1875, *Gamble 36*c (K). Singalelah, 3,350 m., 7 Oct. 1870, *Clarke 13443* (BM). Senchal, 2,450 m., 8 Sept. 1922, *Cave* (E) ; 22 Oct. 1923, *Cave* (E). Kurseong, 2,150 m., 28 Sept. 1884, *Clarke 35990* (K).

S.E. Tibet : Yatung, Amo Chu Valley, 3,200 m., 10 Oct. 1942, *Ludlow & Sherriff 10033* (BM). Reidung, Chumbi Valley, July 1879, *Dungboo* (K). Mago, 3,350–3,650 m., 5 Oct. 1935, *Kingdon-Ward 12399*A (BM, low form).

Nepal : Langtang village area, 3,500 m., 1 Aug. 1949, *Polunin 1513* (BM). Namche Bazar to Dudh Kosi, 3,200 m., *Zimmermann 1729* (G).

Sikkim : Chia Bunjan, 3,350 m., 4 Oct. 1919, *Cave* (E). Rangpo, 2,300 m., 7 Nov. 1876, *Gamble 808* (K). Lachen, 2,750–3,050 m., 6 July 1849, *Hooker* (K) ; 3 Aug. 1849, *Hooker* (K, lectotype) ; 2,450 m., 3 Aug. 1849, *Hooker* (K). Sherabthang, 3,950 m., 22 Aug. 1913, *Cooper 580* (E). " Tumbok ", 3,050 m., 9 Oct. 1870, *Clarke 12756* (BM ; K). " Pankasari ", 2,400 m., 12 Aug. 1912, *Cave* (BM). Without definite locality, 1,800–3,650 m., *Hooker* (BM ; K) ; 2,150 m., 2 Sept. 1849, *Hooker* (K).

Bhutan : Gichha, 2,400 m., 26 Aug. 1914, *Cooper 2894* (BM).

Assam : Iserra, Khasi Hills, 1,500 m., 28 Sept. 1867, *Clarke 5161* (BM). Mairang, Khasi Hills, 1,800 m., July 1850, *Hooker & Thomson 1945* (K). Khasi Hills, 1,800 m., *Hooker & Thomson* (BM ; G). Delei Valley, 3,350–3,650 m., 2 Sept. 1928, *Kingdon-Ward 8628* (K).

Naga Hills : Japvo, 3,000 m., 25 Sept. 1885, *Clarke 41309* (K).

Hooker and Thomson's gathering from Mairang in Assam was included by Haussknecht in his *E. nepalense*, but I am unable to distinguish it from *E. wallichianum* subsp. *wallichianum*. *E. nepalense* is clearly to be typified by a specimen in Herb. Copenhagen collected in Nepal by Wallich ; this specimen is not numbered, but in all probability is a duplicate of *Wallich 6329*A, the type of *E. amurense* subsp. *laetum*.

E. wallichianum subsp. *wallichianum* is a relatively variable taxon that might be further subdivided in the future. The length of the petiole appears not to be correlated with other characteristics.

The following two collections from Nepal are similar to this, but probably distinct, having coriaceous brown scales on the underground parts and apparently a more nodding inflorescence than usual: Khorlak, 3,650–3,950 m., 1929, *Lall Dhwoj 21* (BM; E); Maney Dara, 3,950–4,250 m., 1930, *Lall Dhwoj 0455* (BM; E). The collection by Kingdon-Ward from Assam, cited above, likewise has a few scales on its underground parts.

14*b*. **Epilobium wallichianum** subsp. **souliei** (H. Lév.) Raven, stat. nov.

Epilobium souliei H. Lév. in Bull. Herb. Boiss., Sér. 2, vii: 588 (1907); Ic. Gen. Epil.: t. 121 (1910). [Type: Tongolo, Szechwan, 1893, *Soulié 350* (G).]

Epilobium mairei H. Lév. in Fedde, Repert. Sp. Nov. xii: 283 (1913). [Type: lakes, Ta-Hai plateaux, Yunnan, July 1912, *Maire*, not seen; topotypical material collected by Maire the following year agrees well with the description and is referable to this subspecies.]

Geographical range: central Nepal to Yunnan and Burma, more common eastwards and apparently at higher elevations than subsp. *nepalense*.

S.E. Tibet: Philey La, 4,550 m., 23 July 1914, *Cooper 1721* (BM). Gyamda Chu, Puchu, Kongbo, 2,900 m., 10 Aug. 1938, *Ludlow, Sherriff & Taylor 6804* (BM).

Nepal: Khola Kharka, 4,100 m., 17–19 July 1949, *Polunin 1102* (BM). Mangning, 1,500 m., 13 Aug. 1935, *Bailey's collectors* (BM).

Bhutan: Leji, upper Pho Chu, eastern branch, 3,650 m., 28 June 1949, *Ludlow, Sherriff & Hicks 16661* (BM).

Burma: North Triangle (Tama Bum), 2,750 m., 13 Oct. 1953, *Kingdon-Ward 21464* (BM).

E. wallichianum subsp. *souliei* tends to have larger flowers and a more open habit than subsp. *wallichianum*, but differs consistently only in pubescence.

15. **Epilobium sykesii** Raven, sp. nov. (Plate 34 A.)

Herba perennis; rhizoma crassum, squamis nullis; caulis 15–25 cm. altus, simplex aut in parte superiore valde ramosus, brunneus, angulatus, lineis elevatis strigosis e petiolorum marginibus decurrentibus notatus, ceterum glaber. *Folia* inferiora et media opposita, superiora alterna, omnia subsessilia, lanceolata vel anguste ovata, apice acuta, margine confertim serrulata, basi late cuneata, 1·5–2 cm. longa, 0·5–1 cm. lata, internodiis subaequalia, ad nervos marginemque sparse strigosa. *Inflorescentia* ante anthesin subnutans, cinerea, pilis strigosis dense vestita. *Flores* 8–11 mm. longi. *Hypanthium* infundibuliforme. *Sepala* 5–6 mm. longa, mucronata. *Petala* roseo-purpurea, obcordata, 6–9 mm. longa. *Ovarium* bractea plerumque longius; stylus 4–4·5 mm. longus, basi pilis paucis praeditus; stigma crasse clavatum, 2–3 mm. longum, 2 mm. latum, antheris staminum longiorum anthesis circumdatum. *Capsula* immatura ad 8 cm. longa, dense strigosa; pedicellus c. 5 mm. longus. *Semina* adhuc ignota.

Geographical range: known only from the type locality in central Nepal.

NEPAL: South of Gurjakhani (approximately 28° 36′ N., 83° 13′ E.), 3,050 m.; near small streams; 19 Aug. 1954, *Stainton, Sykes & Williams 3894* (BM, holotype).

E. sykesii, known only from a single collection, is distinct in its broadly clavate stigma and cinereous inflorescence. It is probably related to *E. nepalense* but is separable from that species by its smaller leaves (less than 2 cm. long), short bracts, pubescence, and stigma shape.

This species is named in honour of William Russell Sykes, now of the D.S.I.R., Christchurch, New Zealand, from 1949 to 1957 on the staff of the Royal Horticultural Society's Gardens at Wisley, who collected in Nepal in 1952 with Polunin and Williams and in 1954 with Stainton and Williams.

16. **Epilobium amurense** Hausskn. in Oesterr. Bot. Zeitschr. xxix: 55 (1879); Monogr. Epil.: 203 (1884).—H. Lév., Ic. Gen. Epil.: t. 112 (1910).—Steinb. in Fl. URSS xv: 594 (1949). [Type: Amur River, *Maximowicz* (G; K; LE).]

Geographical range: Hunza and Kashmir in the Western Himalaya, eastwards through the Range to China, eastern Siberia, Japan and Formosa. The Himalayan plants are referable to the following subspecies.

Epilobium amurense subsp. **laetum** (Wall. ex Hausskn.) Raven, stat. nov.

Epilobium laetum Wall., Numer. List: 216, n. 6329 (1832), *nom. nud.*, quoad A.

Epilobium nepalense Hausskn. in Oesterr. Bot. Zeitschr. xxix: 53 (1879); Monogr. Epil.: 218 (1884).

Epilobium tetragonum sensu C. B. Clarke in Hook. f., Fl. Brit. Ind. ii: 586 (1879) pro parte; non L.

Epilobium laetum Wall. ex Hausskn., op. cit.: 218 (1884).—H. Lév., Ic. Gen. Epil.: t. 97 (1910).

Geographical range: Hunza and Kashmir to Yunnan, Szechwan and Hupeh; similar plants are found in Formosa.

JAMMU AND KASHMIR: *Hunza:* Baltit, 2,400 m., 12 Aug. 1954, *Stewart 26474* (BM). *Kashmir:* Pahlgam, 2,300 m., 6 Aug. 1945, *Stewart 21616* (K).

HIMACHAL PRADESH: Simla, *Drummond 24424* (K). Near Phagu, Simla, 2,100 m., Aug. 1884, *Drummond 1580* (K). Narkanda, Simla, 2,750 m., July 1885, *Collett 205* (K).

UTTAR PRADESH: *Kumaun:* Milam, 3,800 m., *Strachey & Winterbottom 12* in part (K).

WEST BENGAL: Tonglo, Darjeeling, 2,750 m., Aug. 1874, *Treutler* (K). Darjeeling, *Hooker* (K). Kurseong, 2,100 m., 28 Sept. 1884, *Clarke 35990* (BM; G). Senchal, 2,450 m., July 1874, *Gamble 2352* (K).

S.E. TIBET: Yatung, 1897, *Hobson* (K). Gyala, Tsangpo Valley, Kongbo, 1,300 m., 23 July 1938, *Ludlow, Sherriff & Taylor 5371* (BM).

NEPAL: Chutta, south-east of Jumla, 3,200 m., 25 July 1952, *Polunin, Sykes & Williams 4916* (BM). Near Ghustang Khola, 2,900 m., 6 July 1954, *Stainton, Sykes & Williams 3390* (BM). Lete, south of Tukucha, Kali Gandaki, 2,400 m., 8 July 1954, *Stainton, Sykes & Williams 1644* (BM). Central Nepal, 1949, *Polunin* (BM). Langtang forest area, 2,900 m., 1 Aug. 1949, *Polunin 1635* (BM). Towards Gosainthan, July 1821, *Wallich 6329*A (BM in part ; G ; K ; isotypes). Without definite locality, *Wallich* (Herb. Copenhagen, lectotype of *E. nepalense*). Tamur Valley, Thapabu Khola, north of Taplejung, 2,900 m., 1 Aug. 1956, *Stainton 1171* (BM).

SIKKIM : Lachen, 2,750–3,050 m., 6 July 1849, *Hooker* (K). Jongri (near Zemu Ram), 3,800 m., 10 July 1849, *Hooker* (K). Batasia, 2,300 m., 25 July 1919, *Cave* (E). Without definite locality, 2,100 m., *Hooker* (K) ; 1,800–3,650 m., *Hooker* (G ; K) ; 3,050 m., July 1880, *Harman 8309* (K).

BHUTAN : Paga, Thimbu, 2,200 m., 9 July 1914, *Cooper 1424* (BM). Thimbu, 2,750 m., 11 Aug. 1914, *Cooper 3427* (BM). Kuru Chu, near Linji, 2,600 m., 22 July 1933, *Ludlow & Sherriff 314* (BM).

I regard this taxon as the Sino-Himalayan element of a very widely distributed Asian species. In western China, where subsp. *laetum* comes into contact with plants that I am unable to distinguish from subsp. *amurense* from further north, the two appear to be separated only by flower colour, the petals of subsp. *amurense* being rose-purple. I am unable to understand Haussknecht's characterization of the seeds of subsp. *laetum* as " sublacunosa ", because all specimens I have examined, including several sheets of the type collection and other collections annotated by Haussknecht, have coarsely papillose seeds. Haussknecht's type was at Berlin and is now lost, but there are isotypes at several other institutions.

17. **Epilobium rhynchospermum** Hausskn., Monogr. Epil. : 211, t. 7 fig. 50 (1884).—H. Lév., Ic. Gen. Epil. : t. 127 (1910).

Geographical range : Western Himalaya from Kashmir to Punjab ; apparently rare and local.

JAMMU AND KASHMIR : *Kashmir :* Baltal, 28 Sept. 1848, *Thomson* (K, lectotype). Pahlgam, 6 Sept. 1920, *Stewart 5963* (K). Kolahoi Valley, 3,650 m., 27 Aug. 1956, *Polunin 56/575* (BM). Kashmir, 27 Sept. 1848, *Thomson* (K) ; 28 Sept. 1848, *Thomson* (K).

PUNJAB : Laka, Dharmsala, 3,350 m., 17 Oct. 1874, *Clarke 24443* (K), *24627* (BM).

18. **Epilobium stracheyanum** Hausskn., Monogr. Epil. : 214, t. 3 fig. 37 (1884).—H. Lév., Ic. Gen. Epil. : t. 92 (1910).

Geographical range : Kumaun.

UTTAR PRADESH : *Kumaun :* Niti, 3,500 m., *Strachey & Winterbottom 5* (BM). Kumaun, 2,100 m., *Strachey & Winterbottom 12* (JE, lectotype).

This species must still be regarded as being very poorly understood. The plants I have included here have flowers 5–6 mm. long and capitate stigmas that are surrounded by the anthers at anthesis. They are well branched from the base. An additional specimen, labelled " Tibet Occ." (*Thomson* (W)), may be referable here.

19. **Epilobium glaciale** Raven, sp. nov. (Plate 34 B.)

Herba perennis humilis ; caulis parte subterranea crista squamarum brunnearum

coriacearum et turionibus globosis carnosis jam tempore florendi praedita, supra terram 5–25 cm. altus, simplex, stramineus, inferne glaber praeter lineas elevatas pubescentes e petiolorum marginibus decurrentes, superne sparse strigosus. *Folia* opposita, petiolata (petiolo 1–3 mm. longo), anguste elliptica, apice acuminata, margine vix serrulata, basi obtusa vel acuta, 1–4·5 cm. longa, 0·6–1·5 cm. lata, internodiis subaequalia, utrinque ad nervos sparsissime strigosa, subcrassa. *Inflorescentia* erecta, sparse glanduloso-pubescens. *Flores* 6–9 mm. longi. *Hypanthium* late infundibuliforme. *Sepala* 4–5 mm. longa, acuta. *Petala* roseo-purpurea, obcordata, 6–7·5 mm. longa. *Ovarium* bracteae subaequale ; stylus c. 2 mm. longus ; stigma capitatum, c. 1·5 mm. latum, antheris anthesi circumdatum. *Capsula* ad 4 cm. longa ; pedicellus brevissimus. *Semina* obovoidea, c. 1 mm. longa, laevia, coma alba 5–6 mm. longa coronata.

Geographical range : Western Himalaya in Baltistan (Karakoram) and Kashmir.

JAMMU AND KASHMIR : *Baltistan :* Sokha Glacier, right bank (approximately 35° 50′ N., 76° 05′ E.), 4,550 m. ; moist rocks ; 21 Aug. 1939, *Scott Russell 1606* (BM, holotype) ; 4,250–4,550 m., 24 Aug. 1939, *Scott Russell 1706* (BM). *Kashmir :* Wangat Valley, 21 Aug. 1940, *Pinfold 264* (BM). Gumber Nullah, Zoji La, 3,500 m., 25 Aug. 1940, *Ludlow & Sherriff 7996* (BM).

E. glaciale is separated from the other species of its area by its stout root-crown and fleshy turions, in combination with its opposite, nearly entire leaves. Apparently the clumps of this plant must be dug carefully in order to preserve the turions.

20. **Epilobium laxum** Royle, Ill. Bot. Himal. Mount. : 211, t. 43 fig. 2 (1835).

Epilobium amplectens Benth. ex Wall., Numer. List : 216, n. 6330 (1832), *nom. nud.*

Epilobium tetragonum var.? *amplectens* C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 587 (1879).

Epilobium duthiei Hausskn., Monogr. Epil. : 205, t. 9 fig. 54 (1884).—H. Lév., Ic. Gen. Epil. : t. 106 (1910).

Epilobium amplectens (C. B. Clarke) Benth. ex Hausskn., op. cit.: 208 (1884).—H. Lév., op. cit. : t. 102 (1910).

Epilobium sadae H. Lév. in Bull. Herb. Boiss., Sér. 2, vii : 588 (1907) ; Ic. Gen. Epil. : t. 85 (1910).

Epilobium subnivale Popov ex Pavlov in Wiss. Ber. Mosk. Staatsuniv. ii : 329 (1934).—Steinb. in Fl. URSS xv : 592 (1949). [Type : on moist banks by small streams near source of River Topchak-su, Khr. Talasskiy-Alatau, Tien Shan range, Russian Turkistan, 24 July 1931, *Pavlov 735* (Herb. Moscow Univ., holotype, not seen ; LE).]

Geographical range : Western Himalaya from Chitral to Kumaun and north to the Tien Shan range.

WEST PAKISTAN : *Chitral :* Dabari Gol, Drosh, 3,650 m., 2 Aug. 1958, *Bowes Lyon 219* (BM). Mandaglasht, 2,750 m., July 1908, *Toppin* (K). *Peshawar :* Above Utrot, 2,750 m., 21 July 1953, *Stewart & Rahman 25231* (BM). Kalam, 2,100 m., 19 July 1953, *Stewart & Rahman 25111* (BM). Nila, Kagan, 22 July 1899, *Duthie* (K). Kagan Valley, 4,400 m., 22 Aug. 1896, *Duthie 19476* (K). Gittidas, 4,300 m., 20 July 1953, *Schmid 463* (G). Besal, 3,800 m., 8–9 July 1953, *Schmid 358* (G).

JAMMU AND KASHMIR : *Gilgit :* Imit, 2,900 m., 2–3 Aug. 1954, *Schmid 2077* (G). Das Kirim to Sardar Kothi, Astor, 3,350 m., 31 July 1946, *Stewart 21994* (K).

Gilgit Expedition, 3,050–3,650 m., 1887, *Giles 619* (K). *Baltistan :* Mani Basin, Haramosh Range, 12 Aug. 1957, *Culbert 8* (BM). Solu Glacier, right bank, 3,800 m., 26 Aug. 1939, *Scott Russell 1735* (BM). Kushuchun Lungmo Valley, 2,900–3,200 m., 29 Aug. 1939, *Scott Russell 1777b* (BM). *Kashmir :* Uri, Saran Range, 24 Aug. 1899, *Duthie* (K). Gali Masalla, Saran Range, 18 Aug. 1899, *Duthie* (K). Killanmarg, 3,050 m., 12 Aug. 1929, *Stewart 13127* (K) ; 3,300 m., 13 Aug. 1956, *Polunin 56/275* (BM). Gulmarg, 2,800 m., *Fuller 122* (K) ; 2,750–3,350 m., Aug. 1922, *Barbour* (BM) ; 3,950 m., 25 Aug. 1926, *Stewart 8849* (K) ; 3,050 m., 5 Aug. 1929, *Stewart 10636* (K) ; 3,050 m., 19 Aug. 1929, *Stewart 10493* (K). Above Gulmarg, 2,750 m., 31 Aug. 1929, *Stewart 10542*A (K). Pir Panjal, 10 Aug. 1901, *Duthie* (K). Fras Nag, 2,750 m., 27 July 1947, *Stewart 23203* (K). Seikwas to Zaiwan, 3,650 m., Sept. 1931, *Stewart 13130* (K). Sonamarg, 3,350 m., 12 Aug. 1919, *Rich 1262* (K) ; 3,350 m., 5 Aug. 1921, *Stewart 6547* (K) ; 2,750 m., 16 Aug. 1922, *Stewart 7335½* (K) ; 2,750 m., 31 Aug. 1927, *Stewart 3473½* (K) ; 3,650 m., 26 July 1928, *Stewart 9804a* (G ; K) ; 3,650 m., 28 July 1928, *Stewart 9804* (G ; K). Pahlgam, 2,100–2,750 m., *Evershed* (BM) ; 3,050 m., *Stewart 8132* (K). Tulion, Pahlgam, 3,650 m., 13–14 July 1925, *Stewart 7838* (K) ; 3,650 m., 30 Aug. 1945, *Stewart 21849* (K). Liddar Valley, 3,050–3,350 m., 28 July 1893, *Duthie 13307* (K) ; Sept. 1913, *Evershed* (BM). Armium Glen, Liddar Valley, 2,750 m., Aug. 1927, *Stewart 9358* (G ; K). Nund Koi, 3,500 m., 14 Aug. 1940, *Pinfold 283* (BM). Kolahoi Valley, 3,200 m., 26 Aug. 1956, *Polunin 56/530* (BM). Pass 14,422 feet, Kolahoi Valley, 4,300 m., 27 Aug. 1956, *Polunin 56/544* (BM). Deosai Pass, 3,650 m., 5 Aug. 1946, *Stewart 22170* (K). Pangi, Chamba, 2,750–3,350 m., 16 Aug. 1899, *Duthie* (K). Arunth to Sach Pass, 3,650 m., *Ellis 1649* in part (K). Between Alwas and Sach Pass, 3,650–4,250 m., 30 Aug. 1896, *Duthie* (K). Sach, upper Chenab Valley, 2,750 m., *Ellis 342*A (K). Drati Pass, upper Chenab Valley, 3,650 m., 1879, *Baden-Powell 167* (K) ; *Ellis 394* (K). Barnaj Nullah, Sapphire Mines, Srinagar, 3,050 m., 9 July 1953, *Ludlow & Sherriff 9160* (BM). " Rangmarg ", 3,950–4,250 m., Aug. 1936, *Timins 209* (BM). " Ghhantir Gah ", 2,750 m., 5–6 Aug. 1954, *Schmid 2122* (G).

HIMACHAL PRADESH : Near Simla, 3,050 m., 7–20 Sept. 1864, *Stolitzka* (W). Near Sirgul, towards Mt. Chor, Simla, *Drummond 1583* (K). Mt. Chor, 3,350 m., *Collett 5459*A (K). Sutlej Valley near Rampur, 1,800–2,400 m., Aug. 1847, *Thomson* (K). Mangsu Pass, Baspa Valley, Simla Hill States, 4,400 m., 18 July 1939, *Sherriff 7452* (BM).

PUNJAB : Churi to Dhar, 15 Aug. 1885, *Drummond 24426* (K). Sisu, Lahul, *Cooper 5200* (E) ; 3,200 m., 8 July 1941, *Bor 11918* (K). Darcha, Lahul, 3,350 m., 4 July 1941, *Bor 3177* in part (K), *13174* (E). Patsio, Lahul, 3,900 m., 18 July 1941, *Bor 15173* (K).

UTTAR PRADESH : *Tehri Garhwal:* Rudugaira Gad, 4,250–4,850 m., 20 July 1883, *Duthie 1046* (BM ; G, holotype of *E. sadae*). Seed from Kedar Kanta, 3,050–3,350 m., *Duthie*, cultivated at Kew 1880 (JE ; K, lectotype of *E. duthiei*). *Kumaun :* Kalam Valley, 3,650–4,000 m., 23 Aug. 1884, *Duthie 2928* (E). Milam, 3,800 m., *Strachey & Winterbottom 12* in part (K). Near Lebung Glacier, 4,250–4,550 m., 3 Aug. 1886, *Duthie 5584* (BM ; G). Kumaun, *Blinkworth* in *Wallich 6330* (BM ; E ; G ; K, lectotype of *E. tetragonum* var. *amplectens*) ; 2,100 m., *Strachey & Winterbottom 12* (BM).

This rather large-flowered species is very common in the meadows of the Western Himalaya. It has long been known as *E. amplectens*, the name used in Wallich's *Numerical List*, but as this was not validly published until 1884 Royle's name *E. laxum* must take precedence. Royle described *E. laxum* as having "caulibus laxis quadrilineatis", but his figure, apparently incorrectly, shows the stem as being pubescent all round; otherwise the illustration is clearly of a plant referable to *E. amplectens*. Haussknecht included with *E. amplectens* some plants that I refer to the entity here described as *E. sikkimense* subsp. *ludlowianum*. *E. duthiei* and *E. sadae* represent forms of *E. laxum* only 20–30 cm. tall, with small, crowded leaves; isotypical material of *E. duthiei* (JE) has coarsely papillose, not smooth, seeds.

21. **Epilobium brevisquamatum** Raven, sp. nov. (Plate 35 A.)

Herba perennis; rhizoma ramosum, squamis brunneis coriaceisque sparse vestitum; caulis 15–40 cm. altus, plerumque simplex, interdum ramosus, stramineus, lineis strigosis e petiolorum marginibus decurrentibus notatus, ceterum glaber. *Folia* plerumque opposita, superiora alterna, omnia subsessilia, ovata, apice acuta, margine conferte leviterque serrulata, basi late cuneata, 2–4 cm. longa, 1–2 cm. lata, internodiis breviora vel superne longiora, utrinque ad nervos marginemque pilis paucis praedita, subcrassa. *Inflorescentia* ante anthesin subnutans, dense glanduloso-pubescens. *Flores* 6–8 mm. longi. *Hypanthium* infundibuliforme. *Sepala* c. 4 mm. longa, apiculata. *Petala* alba, obcordata, 4–5 mm. longa. *Ovarium* bractea plerumque longius; stylus 1·5–2 mm. longus; stigma capitatum, c. 0·8 mm. latum, antheris anthesi circumdatum. *Capsula* 4·5–5·5 mm. longa, glanduloso-pubescens; pedicellus subnullus. *Semina* immatura c. 1 mm. longa, verisimiliter leviter papillosa.

Geographical range: known only from the type locality in central Nepal.

NEPAL: Tukucha, Kali Gandaki (approximately 28° 43′ N., 83° 39′ E.), 3,200 m.; open grass slopes; 22 Aug. 1954, *Stainton, Sykes & Williams 7403* (BM, holotype).

E. brevisquamatum is closely related to *E. laxum*, but is distinguished by its smaller white flowers and more finely serrulate leaves, which are alternate above. In *E. laxum*, which is not known from east of Kumaun, the leaves are opposite nearly to the top of the stem.

22. **Epilobium gouldii** Raven, sp. nov. (Plate 35 B.)

Herba perennis; caulis parte subterranea basi turionibus globosis carnosis praedita, supra terram 20–50 cm. altus, simplex, stramineus, lineis dense strigosis elevatis e petiolorum marginibus decurrentibus notatus. *Folia* inferiora opposita, superiora alterna, omnia subsessilia, apice acuta, margine argute serrulata, basi late rotundata, 2–3 cm. longa, 1–1·5 cm. lata, internodiis plerumque breviora, utrinque ad nervos marginemque leviter strigosa, subcrassa. *Inflorescentia* ante anthesin nutans, dense glanduloso-pubescens, interdum pilis strigosis ad ovaria inter eos glandulosos mixtis. *Flores* 6–7 mm. longi. *Hypanthium* anguste campanulatum. *Sepala* 3·5–4 mm. longa, acuminata. *Petala* roseo-purpurea, obcordata, 4·5–5·5 mm. longa. *Ovarium* bractea valde longius; stylus 3 mm. longus; stigma clavato-capitatum, 1–1·2 mm. longum, antheris staminum longiorum anthesi circumdatum. *Capsula* 5–6 cm. longa, subglabra ; pedicellus ad 1 cm. longus. *Semina* obovoidea, c. 1 mm. longa, leviter papillosa, coma alba 6 mm. longa coronata.

Geographical range : Sikkim and adjacent Tibet.

S.E. TIBET : Nathu La to Champitang, 3,650–4,250 m., 1 Aug. 1936, *Gould 409* (K). Gautsa to Phari Dzong (approximately 28° 53′ N., 89° 33′ E.), 3,650–4,350 m., 13 Aug. 1938, *Gould 1452* (K, holotype). Lingmathang, 3,050 m., 1912, *Rohmoo* (E ; K). Without definite locality, 1882, *King's collector 146* (BM ; K).

SIKKIM : Lachung, 4,550 m., *Hooker* (K).

This species is somewhat similar to *E. laxum* of the Western Himalaya, but that species has mostly opposite, longer-acuminate leaves and usually much larger flowers, among other differences. *E. gouldii* is closer to *E. brevisquamatum*, which however has short brown scales on its underground parts and lacks turions. As in other species, the turions of *E. gouldii* are apparently easily detached in collecting.

The specific epithet honours Sir Basil John Gould (1883–1956) of the Indian Civil Service, part-author of *Tibetan Word Book* (1943) and author of *The Jewel in the Lotus : Recollections of an Indian Political* (1957), for his enterprise in collecting some 2,400 botanical specimens while serving as the Political Officer in Sikkim and for Bhutan and Tibet from 1935 to 1945.

23. **Epilobium sikkimense** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 52 (1879) ; Monogr. Epil. : 204 (1884).—H. Lév., Ic. Gen. Epil. : t. 88 (1910).

Epilobium alsinifolium sensu C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 586 (1879) pro parte ; non Vill.

Geographical range : Tehri Garhwal eastwards through the Himalaya to Yunnan and Szechwan.

23*a*. **Epilobium sikkimense** subsp. **sikkimense.**

Geographical range : central Nepal to Yunnan and western Szechwan, apparently often at higher elevations than subsp. *ludlowianum*.

S.E. TIBET : Changkyepyakop, 4,250 m., 6 Sept. 1911, *Ribu & Rohmoo 5268* (G, fragmentary). Natu La to Champitang, 3,650–4,250 m., 1 Aug. 1936, *Chapman 1077* (K). Tangkar La, north-west Chumbi Valley, 4,250 m., June 1891, *Waddell 32* (K). Khambut, 4,250 m., 10 July 1939, *Gould 2357* (K). Chickchar, 3,650 m., 5 July 1935, *Kingdon-Ward 11902* in part (BM). Tama La, Tsari, 4,400 m., 20 June 1936, *Ludlow & Sherriff 2182* (BM).

NEPAL : Gurkha Nesum, 20 July 1927, *Lall Dhwoj* (E). Shiar Khola, Ganesh Himal, 4,400 m., 15 July 1953, *Gardner 1348* (BM). Dhudkund, 6 miles east of Timure, 3,650 m., 5 July 1949, *Polunin 834* (BM).

SIKKIM : Lachen, 3,950 m., 14 July 1849, *Hooker* (K) ; 4,250 m., 15 July 1849, *Hooker* (K, lectotype). Lhonakh, 28 July–8 Aug. 1903, *Younghusband 196* (G). Tsomgo Lake, 3,650 m., 3 Aug. 1935, *Cutting & Vernay 13* (K). Without definite locality, 23–27 July 1933, *Wager 321* (K) ; 3,050–4,250 m., *Hooker* (BM).

BHUTAN : Gafoo La, upper Phu Chu, 4,400 m., 7 July 1949, *Ludlow, Sherriff &*

Hicks 16769 (BM). Rinchen Chu, 4,700 m., 13 July 1937, *Ludlow & Sherriff 3429* (BM). Dungshinggang (Black Mountain), 3,950 m., 25 June 1937, *Ludlow & Sherriff 3315* (BM). Waitang, Tsampa, 4,100 m., 19 June 1949, *Ludlow, Sherriff & Hicks 19196* (BM). Me La, south side, 4,100 m., 20 June 1949, *Ludlow, Sherriff & Hicks 20377a* (BM).

This is a rather attractive plant which is apparently more common in the mountains of Yunnan than it is in the Himalaya.

23*b*. **Epilobium sikkimense** subsp. **ludlowianum** Raven, subsp. nov. (Plate 36 A.)

A subsp. *sikkimense* differt habitu robustiore; caulibus 15–60 cm. altis; foliis 3–7 cm. longis, 1·5–3 cm. latis, quam internodiis fere brevioribus; stylo basi pilis paucioribus fere investo.

Geographical range: that of the species.

UTTAR PRADESH: *Tehri Garhwal:* Under Sri Kanta, 3,650–3,950 m., 8 Aug. 1883, *Duthie 1043* (K).

WEST BENGAL: Tonglo, Darjeeling, 3,050 m., July 1881, *Gamble 9450* (K).

S.E. TIBET: Yatung, *Hobson* (K). Champitang, 3,650 m., 1 Aug. 1936, *Chapman 625* (K). Kulu Phu Chu, near Paka, Kongbo, 3,350–3,650 m., 23 July 1938, *Ludlow, Sherriff & Taylor 5921* (BM). Nyima La, Kongbo, 3,800 m., 5 July 1938, *Ludlow, Sherriff & Taylor 5140* (BM).

NEPAL: Bhurchula Lekh, south of Jumla, 3,350 m., 19 July 1952, *Polunin, Sykes & Williams 4788* (BM); 3,800 m., 11 July 1952, *Polunin, Sykes & Williams 4532* (BM). Five miles north-east of Maharigaon, 4,250 m., 22 July 1952, *Polunin, Sykes & Williams 278* (BM). Near Balangra Pass, 4,100 m., 21 July 1952, *Polunin, Sykes & Williams 2530* (BM). Near Tarakot, Bheri River, 3,200 m., 6 July 1952, *Polunin, Sykes & Williams 2388* (BM). Taglung, south of Tukucha, Kali Gandaki, 3,650 m., 11 July 1954, *Stainton, Sykes & Williams 1745* (BM). Tukucha, Kali Gandaki, 3,800 m., 21 July 1954, *Stainton, Sykes & Williams 1919* (BM). Seti Khola, Annapurna Himal, 3,800 m., 2 Aug. 1954, *Stainton, Sykes & Williams 6572* (BM). Rambrong, Lamjung Himal, 4,250 m., 10 July 1954, *Stainton, Sykes & Williams 6261* (BM). Chilime Khola, 4,550 m., July 1949, *Polunin 1164* (BM). Shiar Khola, Ganesh Himal, 3,500 m., 14 July 1953, *Gardner 1295* (BM). Khola Kharka, 4,100 m., 17 July 1949, *Polunin 1070* (BM). South of Khola Kharka, 3,650–3,950 m., 15 July 1949, *Polunin 1032* (BM). Langtang Valley, 3,650 m., 23 June 1949, *Polunin 561* (BM). Central Nepal, 1949, *Polunin* (BM). Khumboo, 3,050 m., 1930, *Lall Dhwoj 0169* (BM). Waserk, 3,850 m., 27 Sept. 1937, *Sharma 57/94* (BM). Towards Gosainthan, July 1821, *Wallich 6329*A in part (BM). Maghang Khola, east of Num, Arun Valley, 3,350 m., 2 July 1956, *Stainton 829* (BM). Ghunsa Valley, July 1949, *Wyss-Dunant 1199* (G). Without definite locality, *Wigram 151*A (K). Nepal 21-183-30, cultivated at Kew, 25 June 1931 (K).

SIKKIM: Lachen, 3,050–3,650 m., 2 July 1849, *Hooker* (K); 3,950 m., 15 July 1849, *Hooker* (K). Chomnago, 3,650–3,950 m., 19 July 1913, *Cooper 297* (BM); 3,950 m., 11 Sept. 1913, *Cooper 872* (BM). Yak La, 3,650 m., 18 Oct. 1869, *Clarke 10184* (K). Sherabthang, 3,950 m., 22 Aug. 1913, *Cooper 581* (BM). Tibet Frontier

Commission, 5 Nov. 1903, *Younghusband* (K). " E seminibus Sikkimensibus " (G).

BHUTAN : Pumo La to Pemitanka, 2,500–3,650 m., 8 July 1938, *Gould 936* (K). Singhi Dzong (approximately 27° 55′ N., 91° 13′ E.), 2,400 m. ; in *Abies* forest ; 4 Aug. 1949, *Ludlow, Sherriff & Hicks 21386* (BM, holotype). Rudo La, 3,350 m., 19 July 1933, *Ludlow & Sherriff 292* (BM). Me La, south side, 4,100 m., 20 June 1949, *Ludlow, Sherriff & Hicks 20377* (BM).

BURMA : Adung Valley, sources of the Irrawaddy, 3,650–3,950 m., 28 July 1931, *Kingdon-Ward 9868* (BM).

E. sikkimense subsp. *ludlowianum* is notably distinct from the more congested and shorter subsp. *sikkimense*, but intergrades between the two are numerous, particularly in western China (Yunnan and Szechwan). The following two collections from S.E. Tibet are similar to subsp. *ludlowianum*, but have narrower leaves : Lhasa, 3,800 m., 11 July 1943, *Ludlow & Sherriff 9776* (BM) ; Reting, 60 miles north of Lhasa, 4,400 m., 15 July 1944, *Ludlow & Sherriff 11008* (BM). A proper evaluation of their status will have to await the collection of more Tibetan material. This taxon was confused with the very distinct Western Himalayan *E. laxum* (*E. amplectens*) by Haussknecht, on the basis of the fragmentary material he had. The number of specimens of *E. sikkimense* subsp. *ludlowianum* cited above illustrates graphically the importance of Himalayan collections made in the last two decades towards our understanding of the distribution of the plants found there.

This subspecies, which I at first thought worthy of specific rank when giving it the epithet *ludlowianum*, is named in appreciation of the many services to Himalayan and Tibetan botany of Mr. Frank Ludlow ; his excellent, extensive and well-documented specimens collected in 1924–26 and 1933–47 in southern Tibet, 1929–30 in the Tien Shan, Chinese Turkistan, and 1933–49 in Bhutan have increased beyond estimate our knowledge of the distribution of plants within these areas.

24. **Epilobium trichophyllum** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 53 (1879) ; Monogr. Epil. : 205, t. 3 fig. 38 (1884).—H. Lév., Ic. Gen. Epil. : t. 86 (1910).

Epilobium origanifolium var. *villosum* C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 586 (1879).

Geographical range : Sikkim.

SIKKIM : Latong (near Chotang), 3,500 m., 13 July 1849, *Hooker* (K, holotype of species and of *E. origanifolium* var. *villosum*). Without definite locality, 3,050–3,650 m., *Hooker* (K ; W ; presumably isotypes).

Today we know no more of this species than did Haussknecht in describing it, since no more material has come to light. The only collection is Hooker's, made in Sikkim over a century ago. It is obviously closely related to *E. sikkimense*, but is probably best retained as a distinct species, at least for the present.

25. **Epilobium trilectorum** Raven, sp. nov. (Plate 36 B.)

Herba perennis humilis ; caulis basi subterranea per 2–4 cm. squamis brevibus rotundatis brunneis vestitus, supra terram 15–25 cm. altus, plerumque simplex, interdum sparse ramosus, stramineus, lineis pilosis tenuibus e petiolorum marginibus

decurrentibus notatus, ceterum glaber. *Folia* inferiora opposita, superiora alterna, omnia subsessilia, late elliptica, apice obtusa, margine leviter serrulata, basi late cuneata, 1·5–2·5 cm. longa, 1–1·5 cm. lata, internodiis breviora, utrinque ad nervos marginemque pilis paucis praedita, flaccida. *Inflorescentia* ante anthesin subnutans, sparse glanduloso-pubescens. *Flores* 6–8 mm. longi. *Hypanthium* subcampanulatum, intus prope basin pilis paucis vestitum. *Sepala* 6–8 mm. longa, acuta. *Petala* roseo-purpurea, obcordata, 6–8 mm. longa, nervis prominulis percursa. *Ovarium* plerumque bractea celatum ; stylus c. 3 mm. longus ; stigma capitatum, c. 1·2 mm. latum, antheris staminum longiorum anthesi circumdatum. *Capsula* immatura ad 3 cm. longa, sparse glanduloso-pubescens ; pedicellus subnullus. *Semina* adhuc ignota.

Geographical range : Nepal and adjacent Tibet, Bhutan.

S.E. TIBET : Phung Chu, Arun Valley, 3,500 m., 30 June 1922, *Norton* (K).

NEPAL : Lamjung Himal (approximately 28° 28′ N., 84° 15′ E.), 4,100 m.; forming small clumps on open slopes ; 11 July 1954, *Stainton, Sykes & Williams 6271* (BM, holotype).

BHUTAN : Lonju, 4,100 m., Aug. 1938, *Gould 1309* (K).

E. trilectorum is related to *E. sikkimense,* but instead of the cluster of elongate, leaf-like, brown coriaceous scales that that species has just below the level of the ground it has an area of short, rounded scales along the underground portion of its stem for a distance of up to 4 cm. In addition, the plants of *E. trilectorum* tend to be taller and their leaves proportionately shorter.

The specific epithet refers collectively to J. D. A. Stainton, W. R. Sykes and L. H. J. Williams, three collectors who have added so much to our knowledge of the distribution of plants in Nepal.

26. **Epilobium soboliferum** Raven, sp. nov. (Plate 37 A.)

Herba perennis humilis ; caulis basi subterranea squamis coriaceis brunneis ad 1·5 cm. longis vestitus, ex axillis earum jam tempore florendi soboles tenues edens, supra terram 10–20 cm. altus, plerumque simplex, interdum sparse ramosus, stramineus, lineis elevatis pilosis e petiolorum marginibus decurrentibus notatus, ceterum glaber. *Folia* inferiora opposita, superiora alterna, omnia subsessilia, late elliptica, apice obtusa, margine leviter serrulata, basi cuneata, 1·5–2·5 cm. longa, 1–1·5 cm. lata, internodiis plerumque paulo breviora, utrinque ad nervos marginemque pilis paucis praedita, flaccida. *Inflorescentia* ante anthesin subnutans, sparse glanduloso-pubescens. *Flores* 6–8 mm. longi. *Hypanthium* subcampanulatum, intus ad basin pilis paucis vestitum. *Sepala* 5–6 mm. longa, acuta. *Petala* roseo-purpurea, obcordata, 6–8 mm. longa, nervis prominulis percursa. *Ovarium* plerumque bractea celatum ; stylus c. 3 mm. longus ; stigma capitatum, c. 1·2 mm. latum, antheris staminum longiorum anthesi circumdatum. *Capsula* immatura ad 3 cm. longa, leviter glanduloso-pubescens ; pedicellus subnullus. *Semina* adhuc ignota.

Geographical range : known only from the type locality in south-eastern Tibet.

S.E. TIBET : Rong Chu, Tumbatse, Kongbo (approximately 29° 42′ N., 94° 47′ E.), 3,800 m.; on gravel bed of river ; 1 July 1938, *Ludlow, Sherriff & Taylor 5075* (BM, holotype).

E. soboliferum is related to *E. sikkimense* subsp. *ludlowianum* but easily distinguished by a combination of its campanulate, not cuneate, hypanthium and conspicuous soboles that arise from the basal tuft of coriaceous brown leaf-like scales at the time of flowering. In addition, its styles are glabrous. *E. sikkimense* subsp. *ludlowianum*, on the other hand, has short-stalked very fleshy soboles with imbricate scales arising from the base of the stem in some individuals. The present species is also closely related to an undescribed species found in the mountains of Szechwan.

27. **Epilobium leiophyllum** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 52 (1879) ; Monogr. Epil. : 217, t. 4 fig. 42 (1884).—H. Lév., Ic. Gen. Epil. : t. 107 (1910).

Epilobium origanifolium sensu C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 586 (1879) pro parte ; non Lam.

Geographical range : Western Himalaya from Chitral to Punjab.

WEST PAKISTAN : *Chitral :* Shandur Lake, 3,700 m., Sept. 1909, *Toppin 658* (K). Rosh Gol, N.E. of Tirich Mir, 3,650 m., 5 July 1958, *Stainton 2793* (BM).

JAMMU AND KASHMIR : *Ladakh :* between Leh and Kalatse, 16 Oct. 1848, *Thomson* (K).

HIMACHAL PRADESH : Ravine east of Changor, 29 Aug. 1847, *Thomson* (K).

PUNJAB : Pok, Spiti Valley, 1 Sept. 1847, *Thomson* (K). West of Lara, Spiti Valley, 4 Sept. 1847, *Thomson* (K, lectotype).

Haussknecht's circumscription of this species as comprising only totally glabrous individuals appears not to be tenable, but we do not have much more material at the present time than he did in 1879. A related species from the Tien Shan range is *E. thermophilum* Pauls., of which I have seen an isotype (LE). This is taller and essentially glabrous, with thick, flaccid stems. A great many more specimens will be necessary before the low-growing species of *Epilobium*, particularly of the Western Himalaya, can be properly understood.

28. **Epilobium aitchisonii** Raven, sp. nov. (Plate 37 B.)

Epilobium roseum ? sensu Aitch. in Journ. Linn. Soc. Lond., Bot. xviii : 60 (1880) ; op. cit. xix : 163 (1882) ; non Schreb.

Herba perennis humilis ; caulis parte subterranea squamis paucis brunneis et basi turionibus globosis carnosis praedita, supra terram 10–35 cm. altus, plerumque ramosus, stramineus, glaber praeter lineas duas subelevatas strigosas e petiolorum marginibus decurrentes. *Folia* inferiora opposita, superiora alterna, omnia manifeste petiolata (petiolo 2–4 mm. longo), anguste ovata, apice acuta, margine leviter serrulata, basi late cuneata, 2–3·5 cm. longa, 1–2 cm. lata, internodiis subaequalia, utrinque ad nervos marginemque sparse strigosa, flaccida. *Inflorescentia* ante anthesin subnutans, dense strigosa. *Flores* 4–5 mm. longi. *Hypanthium* infundibuliforme. *Sepala* 3 mm. longa, acuminata. *Petala* roseo-purpurea, obcordata, 3–4 mm. longa, sepalis subaequalia. *Ovarium* bractea multo longius ; stylus 1·5–2 mm. longus ; stigma clavato-capitatum, c. 1 mm. longum, antheris staminum longiorum anthesi circumdatum. *Capsula* 4–5 cm. longa, strigosa ; pedicellus c. 1 cm. longus.

Semina anguste obovoidea, apice rotundata, basi attenuata, 1–1·1 mm. longa, papillosa, coma alba c. 8 mm. longa coronata.

Geographical range : Western Himalaya from the Kurram Valley to Ladakh.

WEST PAKISTAN : Sikaram, Kurram Valley (approximately 33° 54′ N., 70° 20′ E.), 3,350 m. ; in stony beds of streams ; 7 Aug. 1879, *Aitchison 939* (K, holotype).

JAMMU AND KASHMIR : *Baltistan :* Indus Valley, 10 Nov. 1847, *Thomson* (K). *Ladakh :* Near Lamayuru, 19 Sept. 1848, *Thomson* (K). " Tibet Occ.", *Thomson* (K).

E. aitchisonii is similar to *E. leiophyllum* but differs in having petiolate leaves, a densely pubescent inflorescence, sharply papillose seeds, and turions.

This species is named in honour of James Edward Tierney Aitchison (1836–98), from 1858 to 1888 surgeon in the Indian Medical Service and author of " On the Flora of the Kuram Valley, &c., Afghanistan " in Journ. Linn. Soc. Lond., Bot. xviii : 1–113 (1880), based on a collection of 15,000 specimens made while serving with the Kuram Field Force in 1879. He was later naturalist to the Afghan Delimitation Commission of 1884–85.

29. **Epilobium wattianum** Hausskn., Monogr. Epil. : 204, t. 4 fig. 41 (1884).—H. Lév., Ic. Gen. Epil. : t. 89 (1910).

Geographical range : Western Himalaya from Ladakh (?) to Kumaun.

UTTAR PRADESH : *Kumaun* : Milam, 4,000 m., *Strachey & Winterbottom 6* (K).

UNPLACED LOCALITY : " Tibet [Ladakh ?]. 10148 feet. *Bellew* 1873. No. 32. Hort. Kew." (JE ; K, lectotype).

This species is very problematical, and a full understanding must await the availability of further collections. The sheet selected as the lectotype is the only one in the Kew Herbarium so annotated by Haussknecht and is from the same collection as the branch in the Haussknecht Herbarium at Jena, the basis for his illustration (Monogr. Epil. : fig. 41). The species appears to be quite rare and local, and is closely similar to the European *E. alsinifolium* Vill., which, however, is not present even in the Near East. A proper comparison of these species cannot be made with the meagre material of *E. wattianum* available at present.

30. **Epilobium kingdonii** Raven, sp. nov. (Plate 38 A.)

Herba perennis humilis ; rhizoma ramosum, squamis nullis ; caulis 8–20 cm. altus, ramosus, lineis duabus elevatis strigosis e petiolorum marginibus decurrentibus notatus, ceterum glaber. *Folia* inferiora opposita, superiora alterna, omnia subsessilia, ovata, apice acuta, margine confertim serrulata, basi cuneata, 1·5–3 cm. longa, 0·7–2 cm. lata, internodiis subaequalia vel eis vix breviora, utrinque ad nervos marginemque leviter strigosa. *Inflorescentia* ante anthesin subnutans, dense glanduloso-pubescens. *Flores* 7–8 mm. longi. *Hypanthium* subcampanulatum. *Sepala* 4–5 mm. longa, apiculata. *Petala* roseo-purpurea, obcordata, 5–7 mm. longa, nervis prominulis percursa. *Ovarium* plerumque bractea celatum ; stylus 3–4 mm. longus ; stigma capitatum, 1·5 mm. latum, supra antheras anthesi parum elevatum. *Capsula* 2·5–3·5 cm. longa, sparse glanduloso-pubescens ; pedicellus subnullus. *Semina* angustissime obovoidea, c. 1·5 mm. longa, leviter papillosa, coma alba c. 8 mm. longa coronata.

Geographical range: south-eastern Tibet; apparently confined to a small area.

S.E. TIBET: Chayul Dzong (approximately 28° 18′ N., 92° 48′ E.), 3,350 m.; in pastures, amongst thickets of *Hippophae*; 22 Sept. 1935, *Kingdon-Ward 12372* (BM, holotype). Sanga Chöling, 3,650 m., 6 Aug. 1936, *Ludlow & Sherriff 1962* (BM).

Although *E. kingdonii* is superficially similar to many of the other low species of *Epilobium* found in the Himalaya, its technical characters, as given in the key, mark it as another distinct endemic of south-eastern Tibet, a region from which the late Frank Kingdon-Ward (1885–1958) obtained so many botanical novelties. A summary of Ward's life-work as a collector and author will be found in his posthumous *Pilgrimage for Plants* (1960).

31. **Epilobium williamsii** Raven, sp. nov. (Plate 38 B.)

Herba perennis humilis; caulis parte subterranea ad 4 cm. longa squamis nullis e crista squamarum confertarum inferne brunnearum oriens, ad soli superficiem ramosus, supra terram 4–15 (–30) cm. altus, inferne glaber praeter lineas elevatas pubescentes e petiolorum marginibus decurrentes, superne pilosus. *Folia* inferiora opposita, superiora alterna, omnia brevissime petiolata (petiolo 1–2 mm. longo), anguste elliptica vel anguste ovata, apice acuta, margine confertim serrulata, basi late vel anguste cuneata, 1–2·5 cm. longa, 0·5–1·5 cm. lata, internodiis subaequalia, utrinque ad nervos marginemque sparse strigosa, subcrassa. *Inflorescentia* ante anthesin nutans, dense glanduloso-pubescens, interdum pilis strigosis inter eos glandulosos sparsim mixtis. *Flores* 5–8 (–10) mm. longi. *Hypanthium* infundibuliforme. *Sepala* 4–6 mm. longa, acuta. *Petala* roseo-purpurea, obcordata, 4–7 mm. longi. *Ovarium* plerumque bractea celatum; stylus 2–4 mm. longus; stigma capitatum, 1·5–2 mm. latum, antheris anthesi circumdatum. *Capsula* 4–6 cm. longa; pedicellus 1–2 cm. longus. *Semina* adhuc ignota.

Geographical range: Punjab eastwards through the Himalaya to western Yunnan and Szechwan.

PUNJAB: Parbati Valley, Kulu, 3,650 m., 7 July 1952, *Schelpe 3482* (BM).

UTTAR PRADESH: *Kumaun:* Above Dudhpari, 3,650 m., 27 July 1886, *Reid 586* (E).

S.E. TIBET: Phari Dzong, 4,300 m., 21 July 1924, *Kingston 252* (K). Kalaree, 4,900 m., 1912, *Lepcha collector 447* (E; K). Pass I south of Lhasa, 4,000 m., 20 Sept. 1936, *Chapman 627* (K). ¾ mile west of Potola, 3,600 m., 29 Sept. 1936, *Chapman 88* (K). Vicinity of Lhasa, June 1939, *Richardson 193* (BM). Reting, 60 miles north of Lhasa, 4,250 m., 21 July 1942, *Ludlow & Sherriff 8851a* (BM). Chickchar, 3,650 m., 5 July 1935, *Kingdon-Ward 11902* in part (BM). Nambu La, Kongbo, 4,550 m., 14 July 1947, *Ludlow, Sherriff & Elliot 15446* (BM).

NEPAL: Nampa Gad, 4,300–4,600 m., 27 July 1886, *Duthie 5584* (K). Saipal, 4,550 m., 19 Aug. 1954, *Arnold 52* (BM). Bhurchula Lekh, near Jumla, 3,800 m., 11 July 1952, *Polunin, Sykes & Williams 4532a* (BM); 3,650 m., 15 July 1952, *Polunin, Sykes & Williams 4703* (BM). Maharigaon, 4,100 m., 18 July 1952, *Polunin, Sykes & Williams 218* (BM). North-east of Chalike Pahar, 4,250 m., 15 June 1954, *Stainton, Sykes & Williams 3127* (BM). Namdo, north of Mustang, 4,550 m., 9 Aug. 1954, *Stainton, Sykes & Williams 2295* (BM). Taglung, south of Tukucha, Kali Gandaki (approximately 28° 39′ N., 83° 38′ E.), 3,800 m.; open grass slopes; 15 July 1954, *Stainton, Sykes & Williams 1800* (BM, holotype). Jargeng Khola, 4,850 m., 6 July 1950, *Lowndes 1137* (BM). Marsiandi Khola, 3,500 m., 13 July 1950, *Lowndes 1192* (BM).

SIKKIM: Jongri, 4,250 m., 12 Aug. 1913, *Lepcha collector 969* (E).

The following localities lie east of the Himalaya in western China:

SZECHWAN: Mount Saganai above Muli, 4,100–4,300 m., 30 July 1915, *Handel-Mazzetti 7308* (W).

YUNNAN: Litang River divide, 10 miles south-west of Muli, 3,350 m., 23 June 1921, *Kingdon-Ward 4303* (E).

This proposed new species is perhaps most closely related to *E. chitralense* of the Western Himalaya, from which it can be distinguished by the predominantly glandular pubescence of its inflorescence. Some populations of *E. williamsii* have the stems pubescent all round above, but heavier decurrent lines extending downwards from the petioles are still visible.

The specific epithet has been given in appreciation of the contribution of Leonard Howard John Williams to Himalayan botany. Mr. Williams led the British Museum (Natural History) expeditions to Nepal in 1952 and 1954.

32. **Epilobium chitralense** Raven, sp. nov. (Plate 39 A.)

Epilobium cf. *himalayense*, Wendelbo in Nytt Mag. Bot. i: 47 (1952).
Epilobium cf. *stracheyanum*, Wendelbo, loc. cit. (1952).

Herba perennis humilis; caulis parte subterranea squamis nullis e crista squamarum confertarum inferne brunnearum oriens, ad soli superficiem ramosus, supra terram 2–18 cm. altus, inferne glaber praeter lineas elevatas strigosas e petiolorum marginibus decurrentes, superne pilosus. *Folia* plerumque opposita, superiora alterna, omnia subsessilia, anguste ovata, apice acuta, margine serrulata, basi rotundata, 1·5–2 cm. longa, 0·4–0·8 cm. lata, inferne internodiis multo longiora, superne his subaequalia, utrinque ad nervos marginemque sparse strigosa, subcrassa. *Inflorescentia* strigosa, interdum cinerea. *Flores* 5–7 mm. longi. *Hypanthium* late infundibuliforme. *Sepala* 2·5–3 mm. longa, acuminata. *Petala* roseo-purpurea, obcordata, 3·5–4·5 mm. longa. *Ovarium* bractea longius; stylus 2–2·5 mm. longus; stigma capitatum, 0·5 mm. latum, antheris anthesi circumdatum. *Capsula* 3·5–4·5 cm. longa, strigosa; pedicellus subnullus. *Semina* immatura angustissime obovoidea, c. 1·2 mm. longa, papillosa, coma alba c. 5 mm. longa coronata.

Geographical range: Western Himalaya from Chitral to Baltistan (Karakoram).

WEST PAKISTAN: *Chitral:* Wet slope above Shokor Shal, Barum Gol (approximately 36° 14′ N., 71° 58′ E.), 3,600 m., 23 July 1950, *Wendelbo* (BM, holotype; K). Shokor Shal, Barum Gol, 3,500 m., 7 July 1950, *Wendelbo* (BM; K).

JAMMU AND KASHMIR: *Baltistan:* Barpu Glacier, left bank, 3,800 m., 7 July 1939, *Scott Russell 1118* (BM). Hushe Valley, foot of Masharbrum, 3,350 m., 10 July 1955, *Webster & Nasir 6040* (BM; K; W).

E. chitralense is, as already indicated, most similar to *E. williamsii* from further east in the Himalaya. The collection obtained by Wendelbo near the type locality on 7 July 1950 is densely cinereous and resembles *E. royleanum*, but has the characteristic leaf-shape and other attributes of *E. chitralense.* A collection from Punjab (Rangtse La, Lahul, 3,950 m., 16 July 1938, *Bor 9263* (E ; K)) might be referable here, but its leaves are narrow and have petioles 1–2 mm. long, and furthermore are narrowly cuneate at the base.

33. **Epilobium squamosum** Raven, sp. nov. (Plate 39 B.)

Herba perennis humilis ; caulis parte subterranea per 1–2 cm. squamis coriaceis brunneis vestitus, ex axillis earum interdum jam tempore florendi soboles crassas edens, supra terram 10–15 cm. altus, simplex, stramineus, inferne lineis elevatis pilosis e petiolorum marginibus decurrentibus notatus ceterum glaber, superne pilosus. *Folia* plerumque opposita, superiora alterna, omnia subsessilia, conferta, ovata, apice acuta, margine leviter serrulata, basi rotundata, 1·2–2 cm. longa, 0·6–0·8 cm. lata, internodiis longiora, utrinque ad nervos marginemque pilis paucis brevibus praedita. *Inflorescentia* ante anthesin nutans, strigosa. *Flores* 8–10 mm. longi. *Hypanthium* infundibuliforme. *Sepala* c. 6 mm. longa, acuminata. *Petala* roseopurpurea, obcordata, 7–9 mm. longa. *Ovarium* bractea multo longius, curvatum ; stylus c. 6 mm. longus ; stigma capitatum, 1 mm. latum, supra antheras anthesi valde elevatum. *Capsula* immatura ad 4 cm. longa, ad angulos strigosa ; pedicellus subnullus. *Semina* adhuc ignota.

Geographical range : eastern Nepal, perhaps eastwards to Bhutan and western Yunnan.

NEPAL : Chhoyang Khola, west of Num, Arun Valley (approximately 27° 32′ N., 87° 14′ E.), 3,500 m. ; on rocky hillside ; 20 June 1956, *Stainton 726* (BM, holotype).

This fine and very distinct species may be compared with *E. sikkimense* but is easily distinguished by its long, curved, mostly exposed ovaries, nodding inflorescence, and seriate narrow scales on the underground stem. A fragmentary gathering from Bhutan (Dotena, Thimbu, 3,050 m., 30 July 1914, *Cooper 2480* (BM)) appears to belong here, and the following collection from western Yunnan may also be referable to this species : moist pasture and by streams on the eastern flank of the Tali Range, 25° 40′ N., 3,050 m., Aug. 1910, *Forrest 6971* (BM ; E). The last-mentioned collection, however, has flowers only 5–8 mm. long. It has coarsely papillose attenuate seeds 1 mm. long.

34. **Epilobium pseudobscurum** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 53 (1879) ("*pseudo-obscurum*"); Monogr. Epil.: 221 (1884).—H. Lév., Ic. Gen. Epil.: t. 79 (1910).

Epilobium roseum var. *anagallidifolium* C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 585 (1879) pro parte, quoad pl. cit.

Geographical range : Western Himalaya from Ladakh to Punjab ; also in Sikkim and adjacent Tibet.

JAMMU AND KASHMIR : *Ladakh :* Near Leh, 6 Sept. 1848, *Thomson* (K ; W).

PUNJAB : Spiti, 31 Aug. 1847, *Thomson* (K, lectotype).

S.E. TIBET : Without definite locality, *King's collector* (K).

SIKKIM : Jongri, 3,650 m., 15 Oct. 1875, *Clarke 25892* (K).

A gathering from Sikkim (Changu Shapup, 3,950 m., 9 Sept. 1913, *Cooper 844* (E ; K)) is vegetatively similar to *E. pseudobscurum* but has coarsely papillose obovoid seeds with a short pellucid beak, unlike the smooth attenuate seeds of *E. pseudobscurum.* Unfortunately, however, this collection lacks flowers, and more complete material will be necessary before it can properly be placed in the classification of the genus.

35. **Epilobium clarkeanum** Hausskn., Monogr. Epil. : 220, t. 9 fig. 53 (1884).—H. Lév., Ic. Gen. Epil. : t. 113 (1910).

Epilobium alpinum sensu C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 586 (1879) ; non L.

Geographical range : known only from two collections, one each from Sikkim and northern Upper Burma.

SIKKIM : Lachen, 3,650 m., 16 July 1849, *Hooker* (K, lectotype).

BURMA : Adung Valley, sources of the Irrawaddy, 4,250–4,550 m., 8 Aug. 1931, *Kingdon-Ward 9914* (BM).

This is a slender alpine species related to various boreal members of Haussknecht's group *Alpinae.* Its relationship with these cannot, however, be properly evaluated with the scanty material at hand.

36. **Epilobium palustre** L., Sp. Pl. i : 348 (1753).—C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 585 (1879).—Hausskn., Monogr. Epil. : 128, t. 2 fig. 30 (1884).—H. Lév., Ic. Gen. Epil. : tt. 260, 261 (1911).—Steinb. in Fl. URSS xv : 613 (1949).—Ross-Craig, Drawings Brit. Pl. xi : t. 27 (1958). [Type from Europe.]

Epilobium palustre var. *typicum* C. B. Clarke, loc. cit. (1879).
Epilobium palustre var. *majus* C. B. Clarke, loc. cit. (1879). [No authentic material seen.]
Epilobium palustre var. *minimum* C. B. Clarke, tom. cit. : 586 (1879).

Geographical range : circumboreal, in the Himalaya from Kashmir to Kumaun and the vicinity of Lhasa, Tibet ; reappearing in north and west China.

JAMMU AND KASHMIR : *Ladakh :* Nubra Valley, 28 July 1848, *Thomson* (K) ; 4 Aug. 1848, *Thomson* (K) ; 4 Sept. 1848, *Thomson* (K). Near Kharchar, Nubra Valley, 23 July 1848, *Thomson* (K). Taksha to Changlung, 9 Aug. 1848, *Thomson* (K). *Kashmir :* Shol to Chatagarh, 17 June 1848, *Thomson* (K). Deosai, 3,950 m., 31 July 1876, *Clarke 29816* (K, lectotype of *E. palustre* var. *minimum*). Deosai Pass, 3,650 m., 5 Aug. 1946, *Stewart 22149* (K).

UTTAR PRADESH : *Kumaun :* Laptel, 4,550 m., *Strachey & Winterbottom 4* in part (K).

S.E. TIBET : " Mount Everest Expedition 1921 ", 4,550 m., *Wollaston 98* (K). Gyantse, 3,950 m., 31 July 1925, *Ludlow 157* (BM). Vicinity of Lhasa, June 1939, *Richardson 185* (BM).

It appears likely, from the distributional data given above, that this widely distributed species entered the Himalaya from the west. Clarke's remark that the seed of the Indian material of this species is entirely without a beak must have been based on his confusion of this species with the following.

37. **Epilobium minutiflorum** Hausskn. in Oesterr. Bot. Zeitschr. xxix : 55 (1879) ; Monogr. Epil. : 212, t. 4 fig. 40 (1884).—Aitch. in Journ. Linn. Soc. Lond., Bot. xix : 163 (1882).—H. Lév., Ic. Gen. Epil. : t. 135 (1910).—Steinb. in Fl. URSS xv : 620 (1949). [Lectotype : banks of the River Sadsihur (Sajur Suyi ?), Gaziantep (" Aintab "), Turkey, 26 June 1865, *Haussknecht 812* (JE).]

Epilobium modestum Hausskn. in Oesterr. Bot. Zeitschr. xxix : 55 (1879) ; Monogr. Epil. : 211 (1884).—H. Lév., op. cit. : t. 134 (1910).—Steinb., loc. cit. (1949).

Epilobium palustre sensu C. B. Clarke in Hook. f., Fl. Brit. Ind. ii : 585 (1879) pro parte ; non L.

Epilobium tetragonum sensu Aitch., op. cit. xviii : 60 (1880) pro parte ; non L.

Geographical range : Central Anatolia in Turkey eastwards to Kumaun in the Himalaya ; most common in Iran and Afghanistan.

West Pakistan : *Chitral :* Chitral Village, 1,500 m., 11 May 1958, *Stainton 2398* (BM ; W). Golen Gol, 3,050 m., 13 July 1958, *Bowes Lyon 64* in part (BM). *Peshawar :* Shalizan, Kurram Valley, 19 June 1879, *Aitchison 651* (BM in part ; K) ; 19 July 1880, *Aitchison 348* (BM).

Jammu and Kashmir : *Baltistan :* Skardu, 2,300 m., Nov. 1847, *Thomson* (K) ; 2 Aug. 1876, *Clarke 29973* (BM ; K). *Ladakh :* Wandla to Kalatse, 7 July 1848, *Thomson* (K). Nubra Valley, 28 July 1848, *Thomson* (K) ; 1 Aug. 1848, *Thomson* (K) ; 4 Aug. 1848, *Thomson* (K, lectotype of *E. modestum*) ; 6 Sept. 1848, *Thomson* (K). Near Kharchar, Nubra Valley, 23 July 1848, *Thomson* (K). Just north of Leh, 19 July 1848, *Thomson* (K). Kunes, Shyok River, 2–12 Aug. 1856, *Schlagintweit* (JE). *Kashmir :* Dras, 3,050 m., Aug. 1928, *Stewart 10048* (K). Shol to Chatagarh, 17 June 1848, *Thomson* (K).

Uttar Pradesh : *Kumaun :* Laptel, 4,550 m., *Strachey & Winterbottom 4* in part (K).

I can find no consistent and correlated differences between *E. minutiflorum* and a second species described by Haussknecht at the same time, *E. modestum*. Length of the petiole and serrulation of the leaf margins are not correlated with other differences, and, contrary to Haussknecht's descriptions, I am unable to find any differences between these entities in their seeds. Other species have been confused with *E. modestum*, especially in the Near East, and this has tended to obscure the problem of its identity. *E. minutiflorum* is a very distinct species, and is often collected in the Himalaya growing with *E. palustre*.

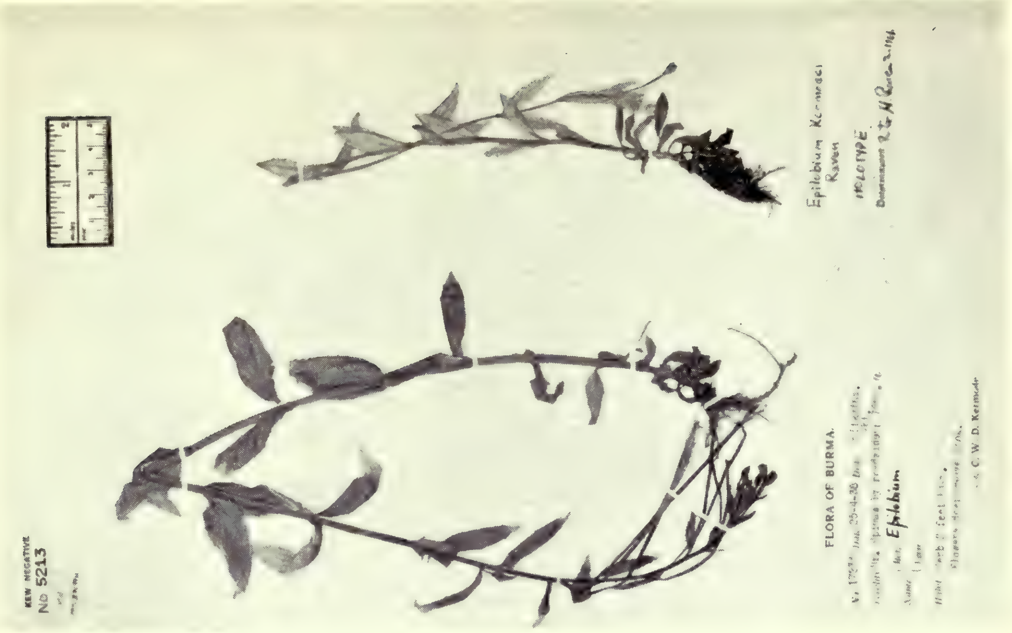
Doubtful species. *Epilobium prainii* H. Lév. in Fedde, Repert. Sp. Nov. ix : 19 (1910) ; Ic. Gen. Epil. : t. 118 (1910). [Type from " Himalaya ".]

It has not been possible to find authentic material of this species in the herbarium at Geneva, and therefore it appears that Léveillé may not have annotated the type there ; and it is quite impossible to identify the species from the short description and rather poor illustration. A comparable case is that of *E. christii* H. Lév., which I have regarded above as a synonym of *E. cylindricum*.

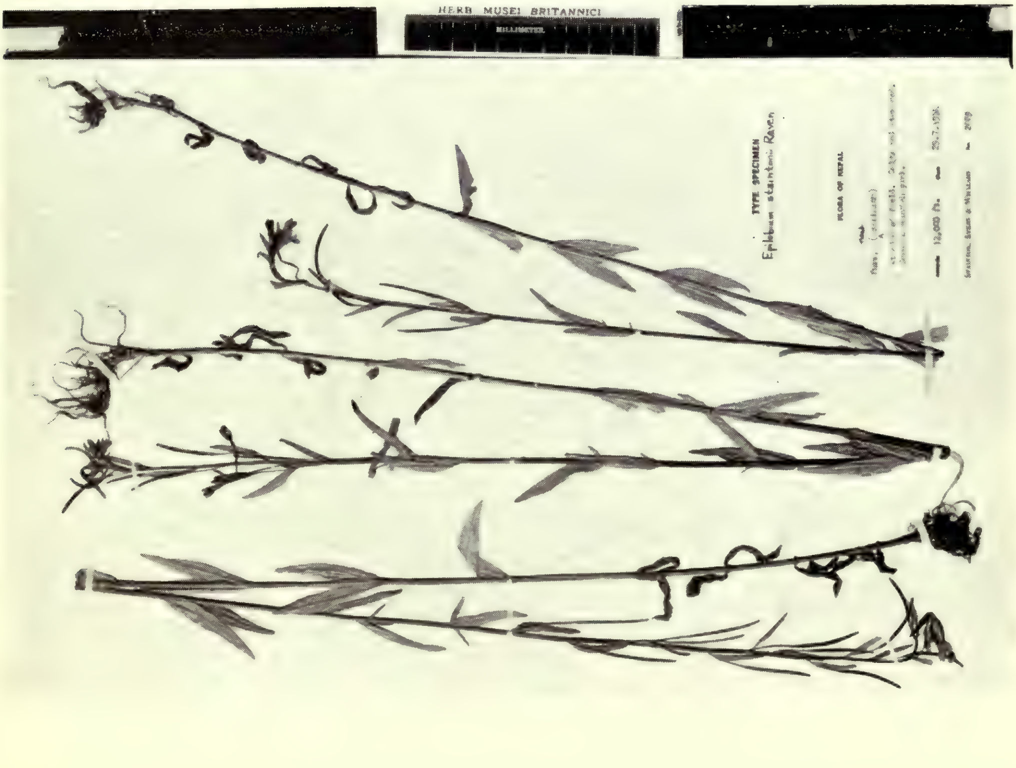
MUSEUM
67

PLATE 33

A. *Epilobium staintonii* Raven
B. *Epilobium kermodei* Raven


KEW NEGATIVE
No 5213
FLORA OF BURMA.
Epilobium
C. W. D. Kermode
Epilobium kermodei Raven
HOLOTYPE

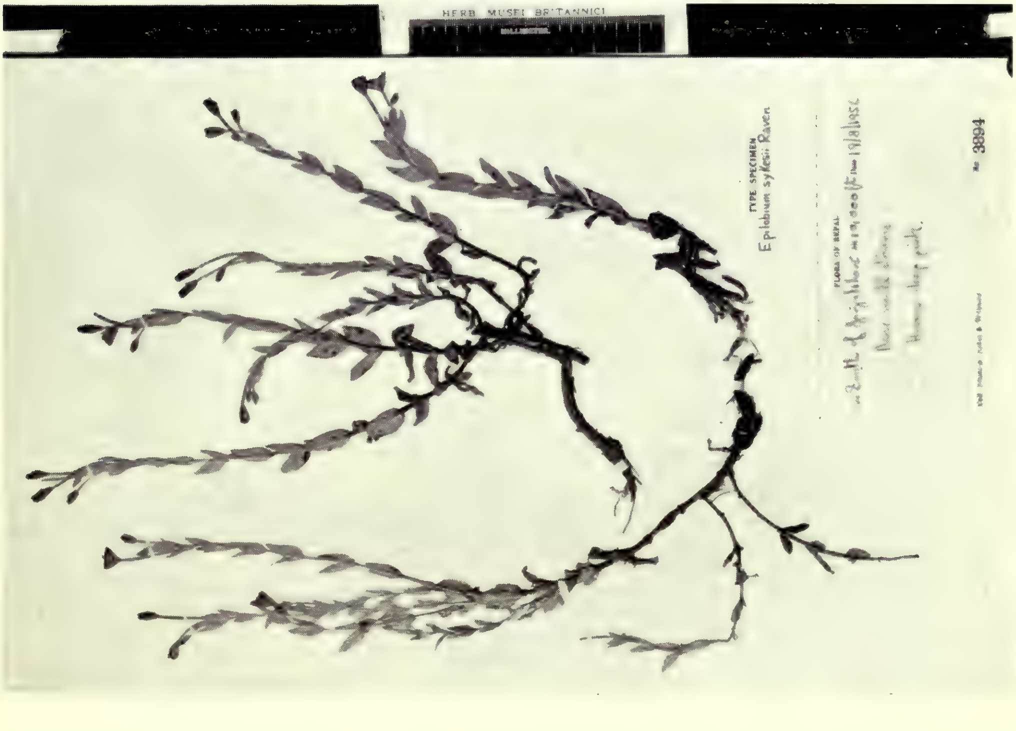
B. Holotype of *Epilobium kermodei* Raven


HERB. MUSEI BRITANNICI
MILLIMETER
TYPE SPECIMEN
Epilobium staintonii Raven
FLORA OF NEPAL
12,000 ft.

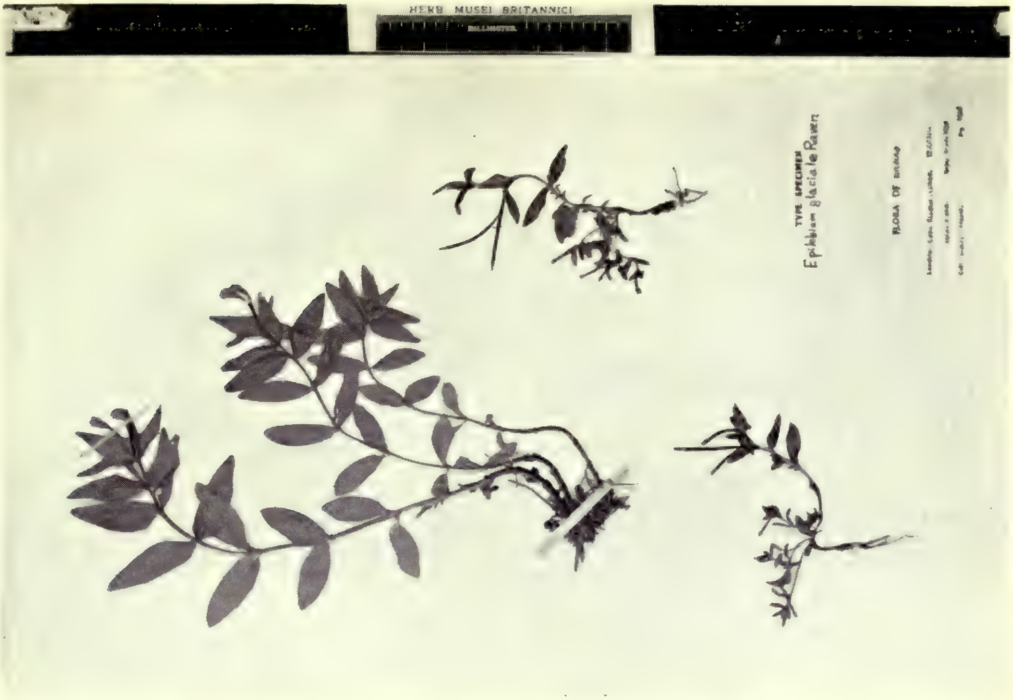
A. Holotype of *Epilobium staintonii* Raven

PLATE 34

A. *Epilobium sykesii* Raven
B. *Epilobium glaciale* Raven


HERB. MUSEI BRITANNICI
TYPE SPECIMEN
Epilobium sykesii Raven
FLORA OF NEPAL
No 3894

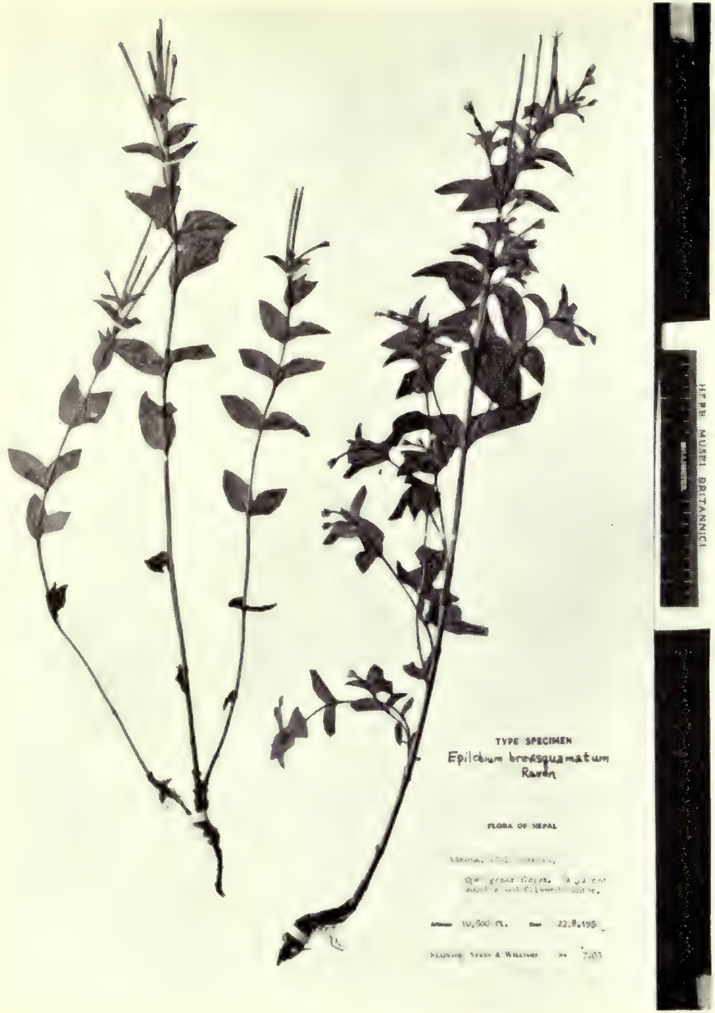
A. Holotype of *Epilobium sykesii* Raven


HERB. MUSEI BRITANNICI
TYPE SPECIMEN
Epilobium glaciale Raven

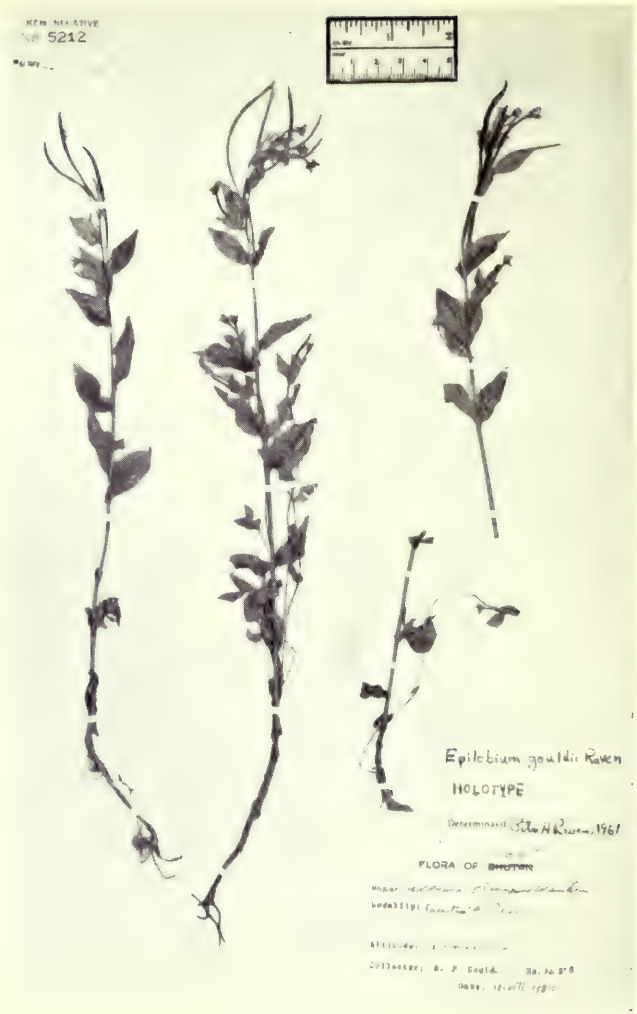
B. Holotype of *Epilobium glaciale* Raven

PLATE 35

A. *Epilobium brevisquamatum* Raven
B. *Epilobium gouldii* Raven


TYPE SPECIMEN
Epilobium brevisquamatum Raven
FLORA OF NEPAL
10,500 ft.
22.8.195
Stainton, Sykes & Williams
HERB. MUSEI BRITANNICI

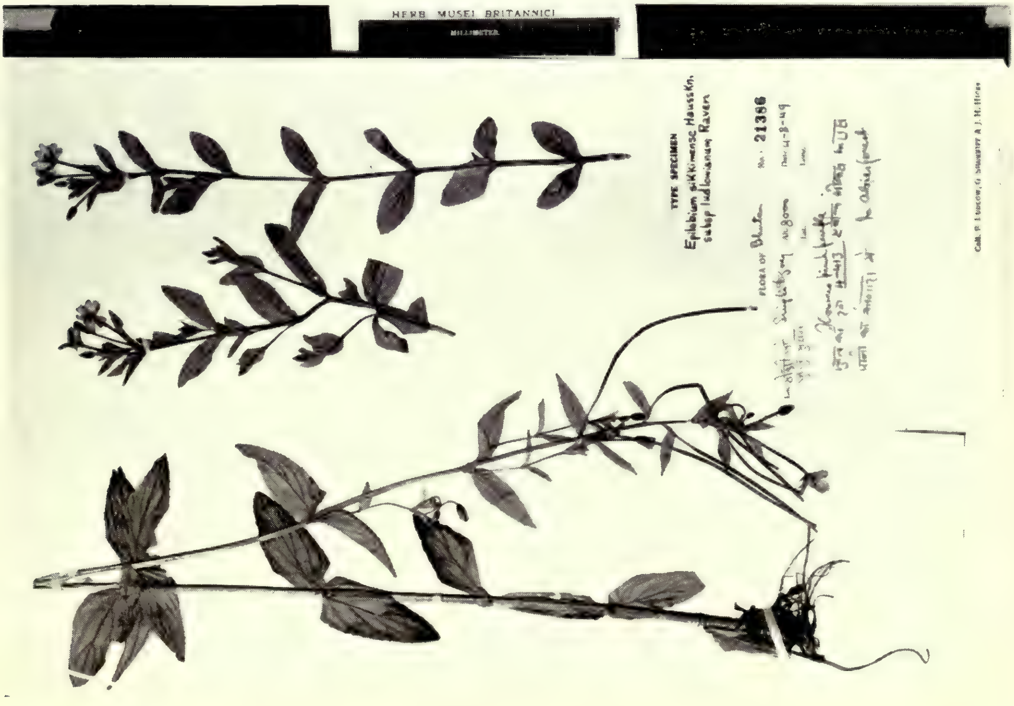
A. Holotype of *Epilobium brevisquamatum* Raven


KEW NEGATIVE
No 5212
Epilobium gouldii Raven
HOLOTYPE
Determinavit Peter H Raven 1961
FLORA OF BHUTAN
Collector: B. J. Gould.

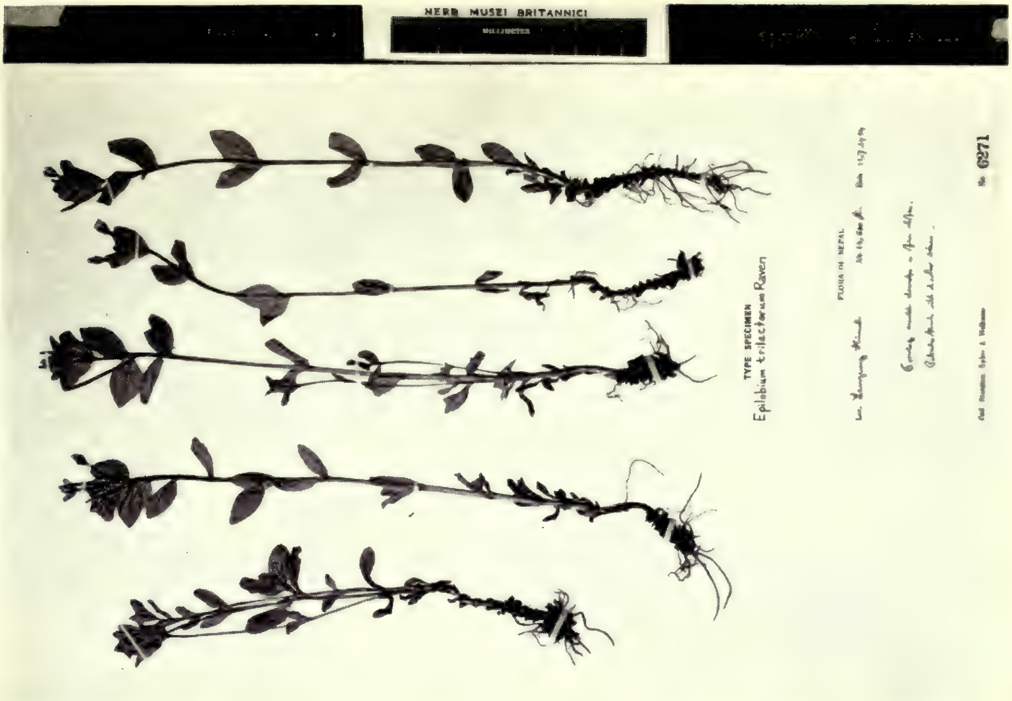
B. Holotype of *Epilobium gouldii* Raven

PLATE 36

A. *Epilobium sikkimense* subsp. *ludlowianum* Raven
B. *Epilobium trilectorum* Raven


HERB. MUSEI BRITANNICI
MILLIMETER
TYPE SPECIMEN
Epilobium sikkimense Hausskn. subsp. ludlowianum Raven
FLORA OF Bhutan
No. 21386
Date 4-8-49
Coll. F. Ludlow, G. Sherriff & J. H. Hicks

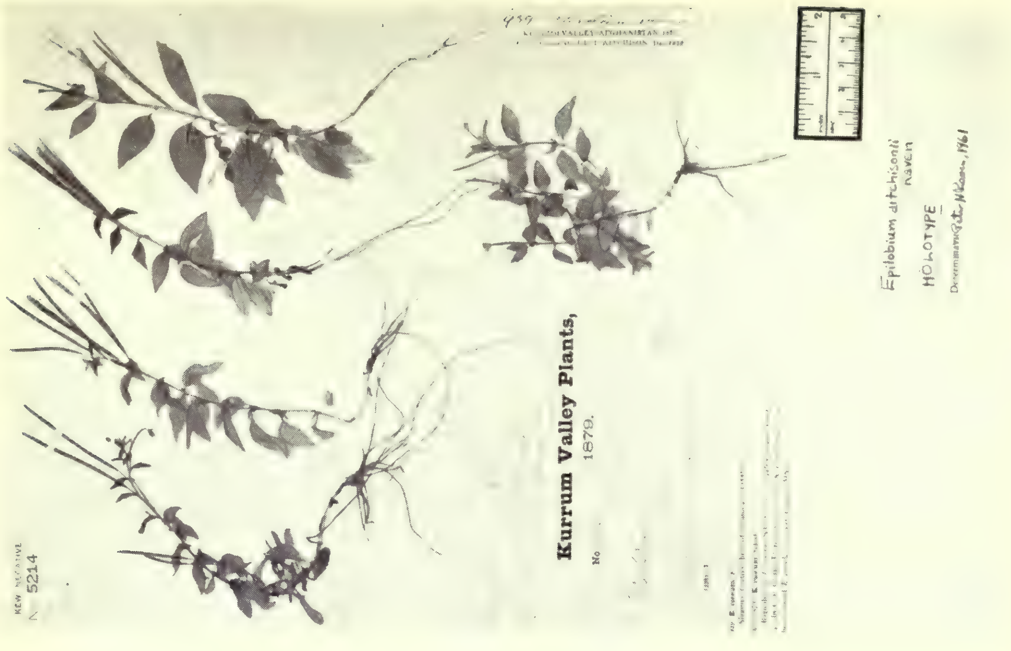
A. Holotype of *Epilobium sikkimense* subsp. *ludlowianum* Raven


HERB. MUSEI BRITANNICI
MILLIMETER
TYPE SPECIMEN
Epilobium trilectorum Raven
FLORA OF NEPAL
No. 6271

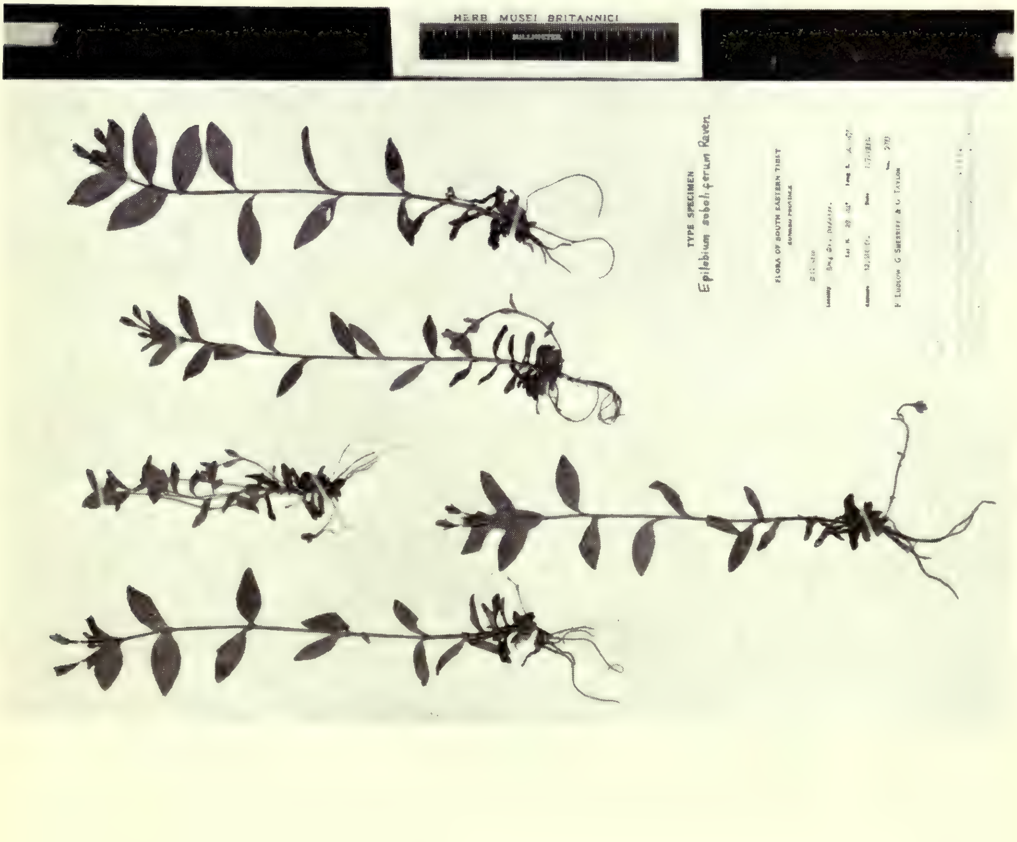
B. Holotype of *Epilobium trilectorum* Raven

PLATE 37

A. *Epilobium soboliferum* Raven
B. *Epilobium aitchisonii* Raven


KEW NEGATIVE
No 5214
Kurrum Valley Plants,
1879.
No
Epilobium aitchisonii
Raven
HOLOTYPE
Determavit P. H. Raven, 1961

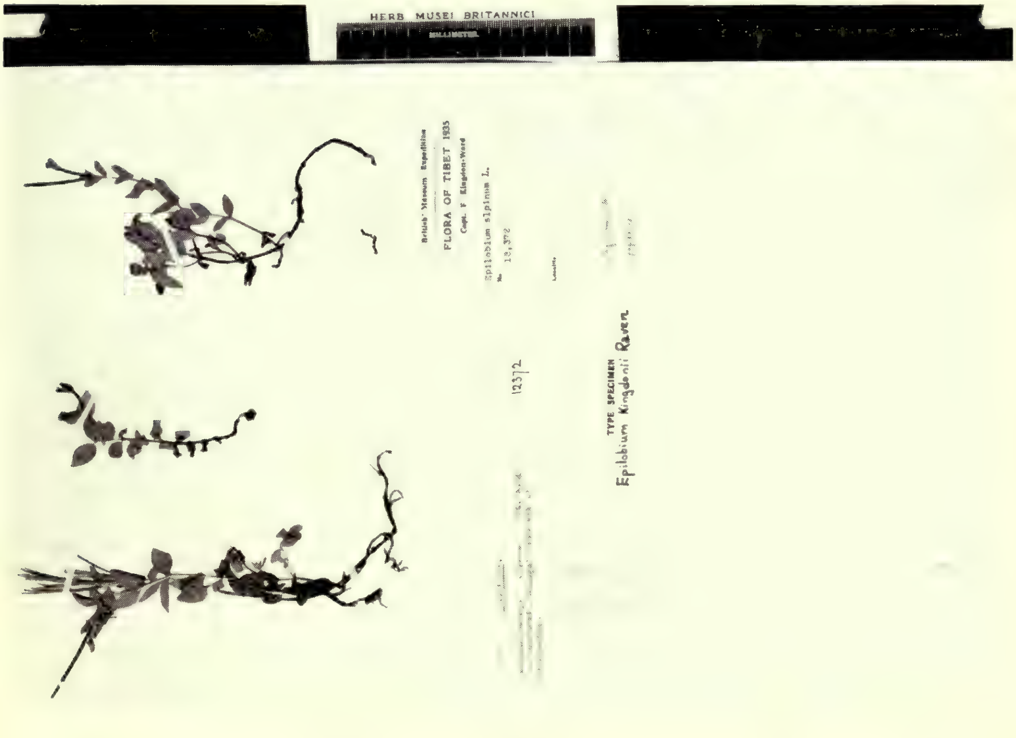
B. Holotype of *Epilobium aitchisonii* Raven


HERB. MUSEI BRITANNICI
TYPE SPECIMEN
Epilobium soboliferum Raven
FLORA OF SOUTH EASTERN TIBET
F. LUDLOW, G. SHERRIFF & G. TAYLOR

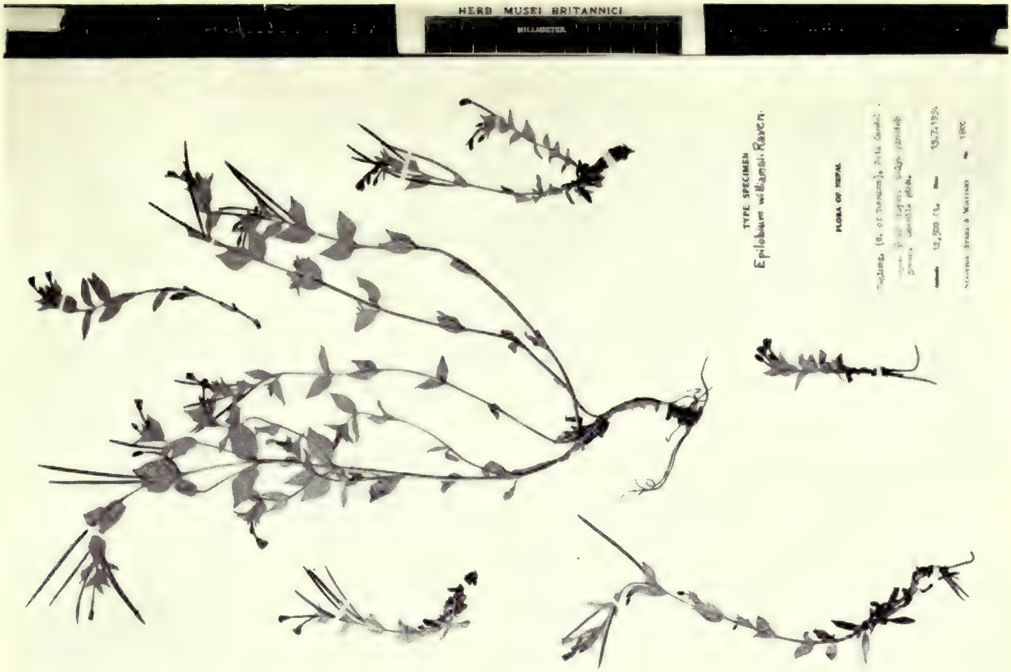
A. Holotype of *Epilobium soboliferum* Raven

PLATE 38

A. *Epilobium kingdonii* Raven
B. *Epilobium williamsii* Raven


HERB MUSEI BRITANNICI
MILLIMETER
British Museum Expedition
FLORA OF TIBET 1935
Capt. F. Kingdon-Ward
Epilobium alpinum L.
No. 13,372
12372
TYPE SPECIMEN
Epilobium Kingdonii Raven

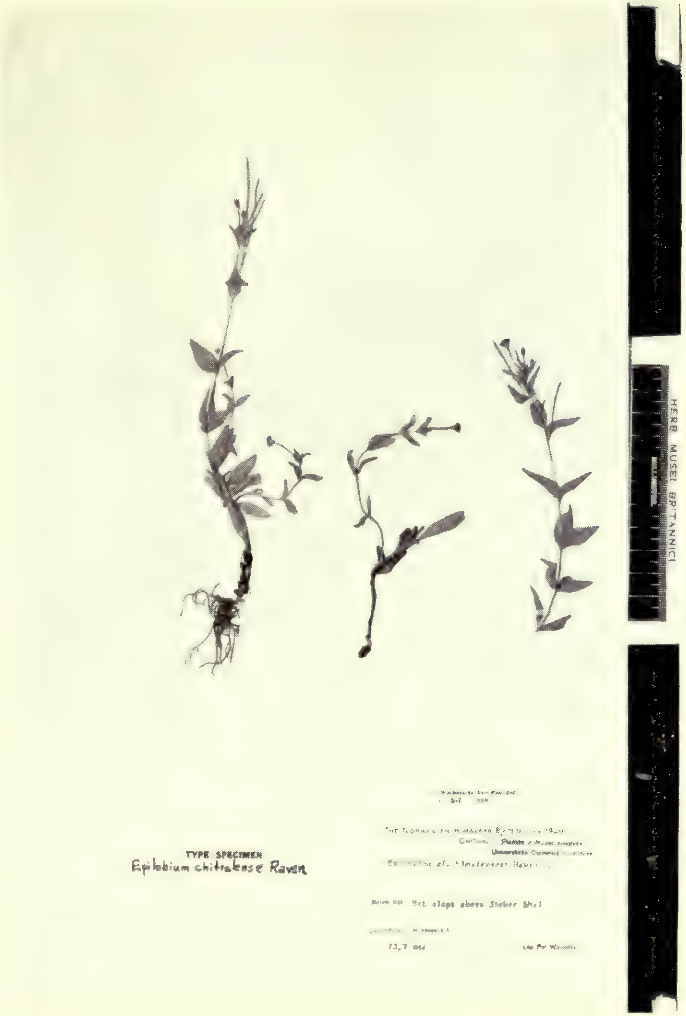
A. Holotype of *Epilobium kingdonii* Raven


HERB MUSEI BRITANNICI
MILLIMETER
TYPE SPECIMEN
Epilobium williamsii Raven
FLORA OF NEPAL

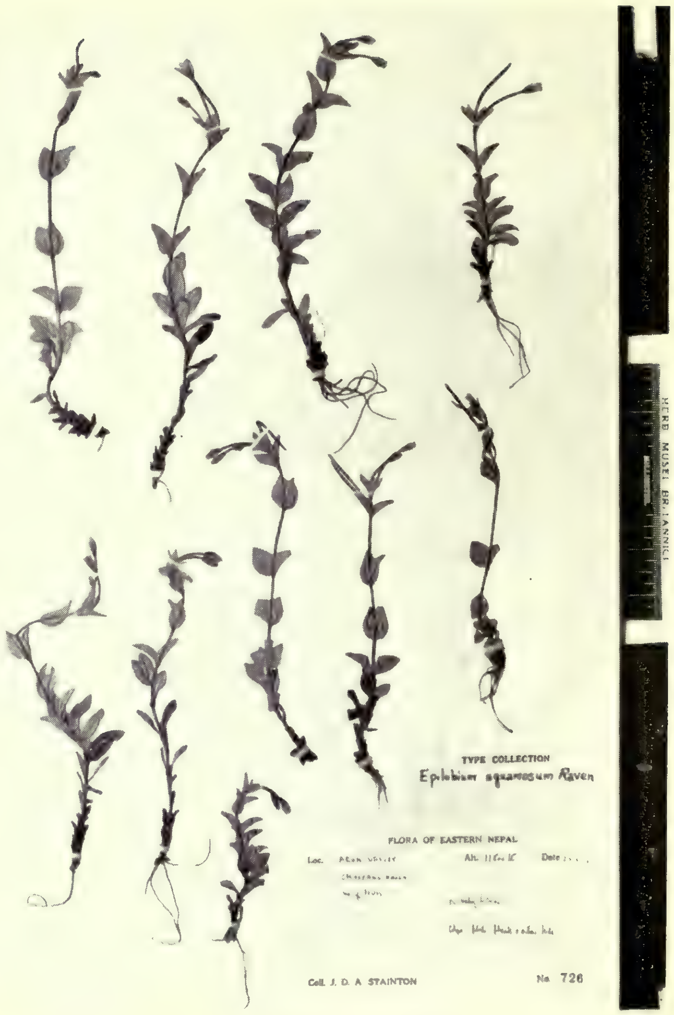
B. Holotype of *Epilobium williamsii* Raven

PLATE 39

A. *Epilobium chitralense* Raven
B. *Epilobium squamosum* Raven


HERB MUSEI BRITANNICI
TYPE SPECIMEN
Epilobium chitralense Raven
Wet slope above Shsher Shal

A. Holotype of *Epilobium chitralense* Raven


HERB MUSEI BRITANNICI
TYPE COLLECTION
Epilobium squamosum Raven
FLORA OF EASTERN NEPAL
Loc.
Alt.
Date
Coll. J. D. A. STAINTON
No. 726

B. Holotype of *Epilobium squamosum* Raven

SUPPLEMENTARY NOTE ON P. C. TSOONG'S " NEW HIMALAYAN SPECIES OF *PEDICULARIS* "

By J. E. DANDY

The first Number of this Volume (pp. 1–34 above) contains an article by P. C. Tsoong on " New Himalayan Species of *Pedicularis* " in which many specific and infraspecific names are proposed as new ; it was published in November 1955. Owing to difficulties in communication at the time between London and Peking, all these new names were earlier published independently by Tsoong in *Acta Phytotaxonomica Sinica,* Vol. iii, No. 3 (January 1955), in a paper entitled " Genus Pedicularis in Ludlow-Sherriff and Polunion [Polunin] Collections ". His comments on taxa given in English in the present volume appear only in Chinese in the *Acta* version, but the latter cites details of localities and collectors for all the taxa which are merely listed by name in the present volume (pp. 31–34 above), and also provides photographs of the type specimens of 22 new species.

The following list collates the references to the new names published in the two papers, the *Acta* references having priority throughout. It is to be noted that in three instances the names are different in the two versions, with the result that *P. taylorii, P. ludlowii* and *P. fletcheriana* become synonymous of *P. tayloriana, P. ludlowiana* and *P. fletcheri* respectively.

Page in present volume	
4	PEDICULARIS OEDERI subsp. BRANCHIOPHYLLA (Pennell) Tsoong in Act. Phytotax. Sin. iii : 274 (" *branchyophylla* "), 316 (" *branchyophylla* ").
4	P. CRYPTANTHA subsp. ERECTA Tsoong, tom. cit. : 275, 316.
5	P. FILICULIFORMIS Tsoong, tom. cit. : 275, 317.
5	*P. filiculiformis* var. *dolichorrhyncha* = P. FILICULIFORMIS var. DOLICHORHYNCHA Tsoong, tom. cit. : 276, 317.
5	P. TAKPOENSIS Tsoong, tom. cit. : 276, 317.
6	P. NEPALENSIS forma ALBA Tsoong, tom. cit. : 277, 317.
6	P. PRZEWALSKII subsp. AUSTRALIS (Li) Tsoong, tom. cit. : 277, 317.
6	P. BELLA subsp. HOLOPHYLLA (Marquand & Shaw) Tsoong, tom. cit. : 277, 318.
6	P. BELLA var. CRISTIFRONS (" *crestifrons* ") Tsoong, tom. cit. : 278, 318.
7	P. LONGIFLORA var. TUBIFORMIS (Klotzsch) Tsoong, tom. cit. : 278, 318.
7	P. SIPHONANTHA subsp. PROSTRATA (Bonati) Tsoong, tom. cit. : 278, 319.
8	P. MEGALOCHILA var. LIGULATA Tsoong, tom. cit. : 279, 320.
8	P. MEGALOCHILA forma RHODANTHA Tsoong, tom. cit. : 279, 320.
8	P. LONGIPEDICELLATA Tsoong, tom. cit. : 280, 321, t. 34 fig. 1 (" *longipedicellala* ").
9	P. RHIZOMATOSA Tsoong, tom. cit. : 281, 321, t. 34 fig. 2.
9	P. PERPUSILLA Tsoong, tom. cit. : 282, 321, t. 35 fig. 1.
10	P. HICKSII Tsoong, tom. cit. : 283, 322, t. 35 fig. 2.
10	*P. taylorii* Tsoong = P. TAYLORIANA Tsoong, tom. cit. : 283, 322, t. 36 fig. 1 (" *Pedicularisa tyloriana* ").
11	P. PSEUDOREGELIANA Tsoong, tom. cit. : 284, 322, t. 36 fig. 2.
11	*P. tantalorrhynchoides* = P. TANTALORHYNCHOIDES Tsoong, tom. cit. : 285, 322, t. 37 fig. 1.
12	P. SHERRIFFII Tsoong, tom. cit. : 286, 322, t. 37 fig. 2.
13	P. ATROVIRIDIS Tsoong, tom. cit. : 287, 323, t. 38 fig. 1.
13	P. ELLIOTII Tsoong, tom. cit. : 287, 323, t. 38 fig. 2.

14 *P. ludlowii* Tsoong = P. LUDLOWIANA Tsoong, tom. cit. : 288 ("*eudlowiana*"), 323, t. 39 fig. 1.
15 P. REPTANS Tsoong, tom. cit. : 290, 323, t. 39 fig. 2.
15 P. POLUNINII Tsoong, tom. cit. : 290, 323, t. 40 fig. 1.
16 P. CANESCENS Tsoong, tom. cit. : 292, 323.
16 P. SPHAERANTHA Tsoong, tom. cit. : 291, 323.
17 P. INCONSPICUA Tsoong, tom. cit. : 292, 323.
18 P. XYLOPODA Tsoong, tom. cit. : 293, 324, t. 40 fig. 2.
19 *P. fletcheriana* Tsoong = P. FLETCHERI ("*fletcherii*") Tsoong, tom. cit. : 294, 324, t. 41 fig. 1.
20 P. SUBULATIDENS Tsoong, tom. cit. : 296, 325.
20 P. DENSISPICA subsp. SCHNEIDERI (Bonati) Tsoong, tom. cit. : 297, 326.
21 P. DENSISPICA subsp. VIRIDESCENS Tsoong, tom. cit. : 297, 326.
21 P. PORRIGINOSA Tsoong, tom. cit. : 297, 326, t. 41 fig. 2.
21 P. RHYNCHOTRICHA Tsoong, tom. cit. : 299, 327.
22 P. PYRAMIDATA subsp. MULTIFLORA (Pennell) Tsoong, tom. cit. : 300, 327.
22 P. OLIVERANA ("*oliveriana*") subsp. LASIANTHA Tsoong, tom. cit. : 300, 327 ("*olivouiana*").
23 P. MUCRONULATA Tsoong, tom. cit. : 300, 328, t. 42 fig. 1.
24 P. IMBRICATA Tsoong, tom. cit. : 301, 328, t. 42 fig. 2.
24 P. PLATYCHILA Tsoong, tom. cit. : 301, 328.
25 P. ANGUSTILOBA Tsoong, tom. cit. : 303, 328, t. 43 fig. 1 ("*Pediculars*").
25 P. KONGBOENSIS Tsoong, tom. cit. : 304, 329, t. 43 fig. 2.
26 P. KONGBOENSIS var. OBTUSATA Tsoong, tom. cit. : 305, 329.
26 P. RETINGENSIS Tsoong, tom. cit. : 305, 329, t. 44 fig. 1.
27 P. PETELOTII Tsoong, tom. cit. : 308, 330 ("*hetelotii*").
28 P. PLICATA var. APICULATA Tsoong, tom. cit. : 309, 331.
28 P. SIAMENSIS Tsoong, tom. cit. : 310, 331.
29 P. SHAWII Tsoong, tom. cit. : 309, 331.
29 P. ROYLEI var. BREVIGALEATA Tsoong, tom. cit. : 311, 332.
29 P. DIFFUSA subsp. ELATIOR Tsoong, tom. cit. : 312, 332.
30 P. KANSUENSIS subsp. VILLOSA Tsoong, tom. cit. : 311, 332.
30 P. SZETSCHUANICA subsp. ANGUSTIFOLIA (Bonati) Tsoong, tom. cit. : 311, 332.
30 P. STENOTHECA Tsoong, tom. cit. : 312, 332, t. 44 fig. 2.
31 P. CHEILANTHIFOLIA var. ALBIDA (Pennell) Tsoong, tom. cit. : 312. 332.

INDEX TO VOLUME 2

The page numbers of the principal references and the new taxonomic names are printed in **bold-face** type, synonyms in *italics*. Names of infraspecific taxa are indexed only when they are new or are synonyms.

Acidodontium ramicolum **58**
  seminerve **58**
  subrotundum **58**
Acrocryphaea rubricaulis **60**
Acroporium pungens **48, 63**
Acrostichum heterophyllum 135
  lanceolatum 133, 141
  punctatum 143
  variabile 140
  wallii 141
Allantodia brunoniana 317
  hohenackerana 284
  javanica 317
  pinnata 301
  solenopteris 286
    var. *pusilla* 287
Allium and Milula in the central and eastern Himalaya 159–191
Allium **171**
  acidoides **178**
  aitchisoni 174
  ascalonicum 181
  atrosanguineum **184**
  bakeri 174
  blandum 173
  carolinianum **173**
  chalcophengos 185
  chinense **174**
  chrysanthum **175**
  coeruleum 182
  cyaneum var. *brachystemon* 178
  eduardi **173**
  ellipticum 171
  exsertum 174
  fasciculatum **183**
  fischeri 173
  forrestii **177**
  fragrans 179
  fragrans var. *nepalense* 180
  gageanum 183
  hierochuntinum 181
  hookeri **183**
  hypsistum **188**
  jacquemonti 173
  junceum 173
  kansuense 178
  kingdonii **175**
  lancifolium **183**
Allium—*contd.*
  macranthum **186**
  mairei **177**
  monadelphum 184
    var. *tibeticum* 185
  nuristanicum 173
  obtusifolium 174
  odorum 179
  oviflorum 186
  phariense **175**
  polyphyllum 173
  prattii **171**
    var. *ellipticum* 171
  przewalskianum **173**
  rhabdotum **187**
  roxburghii 179
  sikkimense **178**
  simethis 186
  sinicum 179
  sp. **189**
  stoliczki 173
  stracheyi **174**
  sulvia 179
  thomsoni 174
  tibeticum 178
  triquetrum 174
  tuberosum **179**
  victorialis 171
  victorialis var. *angustifolium* . . . 171
  violaceum 182
  yunnanense 177
  wallichii **182**
  wallichii 183
Aloinella cucullifera **56**
Amphidium cyathicarpum **53**
Anacolia laevisphaera **59**
Anapausia decurrens 140
ANDREACEAE 51
Andreaea brevipes **51**
  vulcanica **51**
Androsace **ciliifolia** **76**
  hemisphaerica **76**
Anisocampium **281**
  cumingianum **281**
Anisogonium 309
  esculentum 310
  smithianum 310
  sylvaticum 301

- Anisothecium campylophyllum **52**
  - jamesoni **52**
- Anoectangium euchloron **40, 53**
- Anomobryum **antillarum** **41**
  - filiforme **58**
  - prostratum **58**
  - semiovatum **58**
- Aongstroemia julacea **52**
- Aquilegia alpina 200
  - *aquilegioides* 200
  - einseleana 195, 197, 200
  - vulgaris 197, 200
- *Aspidium boryanum* 282
  - *divisum* 282
  - *macrocarpon* 288
  - *nigripes* 285
  - *otaria* 281
- *Asplenium ambiguum* 310
  - *asperum* 306
  - *aspidioides* 286
  - *assimile* 308
  - *australe* 308
  - *blumei* 306
  - *brunonianum* 317
  - *ceylanense* 286
  - *dilatatum* 303
  - *diversifolium* 303
  - *elatum* 301
  - *esculentum* 310
  - *filix-femina* 285
  - *gymnogrammoides* 287, 290, 312
  - *heteropteron* 310
  - *hohenackeranum* 284
  - *javanicum* 317
  - *lanceum* 295
  - *lasiopteris* 296
  - *latifolium* 303
  - *macrocarpon* 288
    - var. *atkinsonii* 289
  - *maximum* 300, 303
  - *muricatum* 312
  - *nigripes* 285, 286, 290
  - *polypodioides* 306
    - var. *β* 300
  - *polyrhizon* 298
  - *procerum* 312
  - *schkuhrii* 299
  - *smithianum* 310
  - *solenopteris* 286
  - *subsinuatum* 295
  - *sylvaticum* 301
  - *thwaitesianum* 300
  - *thwaitesii* 296
  - *travancoricum* 305
  - *umbrosum* var. *assimile* 308
  - *umbrosum* var. *procerum* 312
  - *zeylanicum* 295
- *Asplenium* subgen. *Pseudallantodia* 312
- Aster **retusus** **69**
- Athyrioid ferns of Ceylon, The 275–323
- Athyrium **283**
  - anisopterum **289**
  - *asperum* 306
  - *assimile* 308
  - *australe* 312
  - *blumei* 306
  - *boryanum* 282
  - *brunonianum* 317
  - *ceylanense* 286
  - *cognatum* 308
  - *costale* 290
  - *cumingianum* 281
  - *dilatatum* 303
  - *dubium* 295
  - *esculentum* 310
  - *gymnogrammoides* 287, 312
    - var. *erythrorachis* 291
  - hohenackeranum **284**
  - *javanicum* 317
  - macrocarpon **288**
    - var. *atkinsonii* 289
  - *macrocarpon* 289
  - macrocarpon × praetermissum **292**
  - *muricatum* 312
  - nigripes **285**
  - *nigripes* 290
  - *otaria* 281
  - *pectinatum* 286
  - *pinnatum* 301
  - praetermissum **290**
    - var. erythrorachis **291**
    - var. tripinnatum **291**
  - praetermissum × solenopteris **293**
  - *procerum* 312
  - *procumbens* 315
  - *scandicinum* 286
  - solenopteris **286**
  - *solenopteris* 285, 290
  - *tenuifrons* var. *stramineum* 285
  - *tenuifrons* var. *tenellum* 285
  - *umbrosum* var. *muricatum* 312

- Barbella tenuissima **61**
- Barbula agraria **40**
  - cruegeri **56**
  - ecuadorensis **56**
  - inequalifolia **56**
  - rectifolia **56**
  - replicata **56**
  - subulifolia **40**
- Bartram, E. B. 35–64
- Bartramia flavicans **59**
  - mathewsii **59**
  - potosica **59**
- BARTRAMIACEAE 41, 59
- Bell, P. R., Mosses of the Ecuadorian Andes collected by 51–64
- Belvisia **139**
  - mucronata **140**
  - revoluta **139**

- Brachymenium crinitum, **58**
  - speciosum, **58**
- BRACHYTHECIACEAE, 48, 63
- Brachythecium conostomum, **63**
  - laetum, **63**
  - stereopoma, **63**
- Breutelia allionii, **59**
  - **dominicensis**, **42**
  - integrifolia, **59**
  - scariosula, **59**
  - scoparia, **42**
  - tomentosa, **59**
- BRYACEAE, 41, 57
- Bryum andicola, **58**
  - argenteum, **58**
  - candicans, **58**
  - capillare, **58**
  - concavum, **58**
  - crugeri, **41, 58**
  - erythroneuron, **58**
  - rubrifolium, **41**
  - sericeum, **58**
  - subpilosum, **58**

- Callicostella belangeriana, **46**
  - depressa, **46**
  - filescens, **46**
  - herminieri, **45**
  - longipedunculata, **46**
  - subfissidentoides, **46**
- *Callipteris ambigua*, 310
  - *esculenta*, 310
  - *paradoxa*, 310
  - *smithiana*, 310
  - *sylvatica*, 301
- *Caloscordum exsertum*, 174
- Calymmodon, **154**
  - cucullatus, **154**
  - *glabrescens*, 154
- CALYMPERACEAE, 39
- Calymperes disciforme, **40**
  - donnellii, **40**
  - guildingii, **40**
  - lonchophyllum, **40**
  - richardi, **40**
- *Campium decurrens*, 140
  - *metallicum*, 141
  - *wallii*, 141
  - *zeylanicum*, 140, 141
- Campylopus arctocarpus, **39**
  - brachyphyllus, **53**
  - **capitulatus**, **52**
  - cavifolius, **52**
  - **elliottii**, **38**
  - introflexus, **52**
  - leucognodes, **52**
  - porphyreodictyon, **39, 53**
  - richardi, **39, 53**
  - saxatilis, **38**
- Ceratodon purpureus, **52**
- Ceylon, The Athyrioid ferns of, 275–323
  - The Polypodiaceae and Grammitidaceae of, 131–158
- *Chamaenerion angustifolium*, 346
  - *latifolium*, 348
  - *reticulatum*, 350
- *Cornopteris boryana*, 282
- Crossomitrium herminieri, **47**
  - subepiphyllum, **47**
- Cryphaea pilifera, **60**
  - ramosa, **60**
- CRYPHAEACEAE, 60
- Crypsinus, **145**
  - **montanus**, **145**
  - **oxylobus**, **145**
- Ctenidium malacodes, **64**
- *Ctenitis boryana*, 282
- Ctenopteris, **155**
  - *contigua*, 157
  - *corticola*, 155
  - glandulosa, **155**
  - *khasyana*, 157
  - moultonii, **155**
  - *obliquata*, 156
  - repandula, **156**
  - subfalcata, **156**
  - *subminuta*, 156
  - **thwaitesii**, **155**
- Cyclodictyon albicans, **45**
  - capillatum, **62**
- *Cyclodium cumingianum*, 281
- *Cyclophorus gardneri*, 134
  - *porosus*, 134

- Daltonia bilimbata, **62**
  - jamesoni, **62**
  - lindigiana, **62**
  - stenophylla, **44**
  - trachyodonta, **62**
- Dandy, J. E., 383–384
- Daphne **macrantha**, **77**
- *Davallia alata*, 157
  - *contigua*, 157
  - *emersonii*, 157
- De Beer, G. R., 193–202
- *Dendroglossa wallii*, 141
  - *zeylanica*, 140
- Desmatodon **bellii**, **56**
- DICRANACEAE, 38, 52
- Dicranella brachyblepharis, **38**
  - herminieri, **38**
  - hilariana, **52**
  - perrottetii, **38**
  - subinclinata, **38**
- Dicranoweisia fastigiata, **53**
- Didymodon arcuatus, **55**
  - jamesoni, **55**
- *Digrammaria esculenta*, 310
- Diplazium, **293**
  - sect. **Anisogonium**, **309**

Diplazium—*contd.*
  sect. Diplazium **295**
  subgen. Diplazium **295**
  subgen. **Pseudallantodia** **312**
  asperum 306
  assimile 308
  beddomei **299**
  cognatum **308**
  decurrens **300**
  decussatum 298
  dilatatum **303**
    var. *minus* 300
  diversifolium 303
  elatum 301
  esculentum **310**
  firmum 301
  japonicum 296, 298
  javanicum 317
  katzeri 316
  lanceum 295
  lasiopteris **296**
  latifolium 303
  marginatum 306
  muricatum **312**
  paradoxum **310**
  pinnatifidum 295
  polypodioides **306**
    var. **brachylobum** **307**
    var. *decurrens* 300
  polyrhizon **298**
  procumbens **315**
  schkuhrii 299
  smithianum 310
  subsinuatum **295**
  sylvaticum **301**
  thwaitesii 296
  travancoricum **305**
  umbrosum var. *assimile* 308
  umbrosum var. *australe* 312
  umbrosum var. *procerum* 312
  zeylanicum **295**
Distichophyllum cubense 45
  dussii 45
  longipilum 45
DITRICHACEAE 52
Ditrichum gracile **52**
Dominica, Mosses of 37–49
Drymoglossum **135**
  heterophyllum **135**
  piloselloides 135
Drynaria **144**
  linnei 144
  quercifolia **144**
  sparsisora **144**
Dryoathyrium **282**
  boryanum **282**
Dryopteris boryana 282
  divisa 282
  otaria 281
Dubyaea **stebbinsii** **74**
Ectropothecium apiculatum **49**
  laevifolium 49
Ecuadorian Andes, Mosses of the 51–64
Encalypta coarctata **53**
ENCALYPTACEAE 53
Entodon jamesoni **63**
ENTODONTACEAE 63
Entosthodon acidotus **57**
Epilobium in the Himalayan region, The genus 325–382
Epilobium **346**
  sect. Chamaenerion 331
  sect. Epilobium 331
  sect. *Lysimachion* 332
  aitchisonii **376**
  alpinum 381
  alsinifolium 372
  amplectens 369
  amurense **367**
    subsp. **laetum** **367**
  angustifolium **346**
  beauverdianum 355
  brevifolium **361**
    subsp. **pannosum** **363**
    subsp. **trichoneurum** **362**
  brevisquamatum **371**
  chitralense **379**
  christii 355
  clarkeanum **381**
  conspersum **350**
  cordouei 362
  cylindricum **355**
  cylindricum 357
  decussatum 328
  duclouxii 365
  duthiei 369
  esquirolii 362
  gerardianum 349
  glaciale **368**
  gouldii **371**
  herbertianum 328
  himalayense 358
  himalayense (cf.) 379
  himalense 328
  hirsutum **352**
    var. *laetum* 352
    var. *sericeum* 352
    var. *tomentosum* 352
  hookeri 362
  indicum **358**
  kermodei **364**
  khasianum 363
  kingdonii **377**
  laetum 352, 367
  laeve 328
  latifolium **348**
    subsp. **speciosum** **349**
  laxum **369**
  leiophyllum **376**
  leiospermum **357**

Epilobium—*contd.*
  lividum 358
  mairei 366
  minutiflorum **382**
  modestum 382
  nepalense 365, 367
  nuristanicum 357
  origanifolium 376
  origanifolium var. *villosum* 374
  palustre **381**
    var. *majus* 381
    var. *minimum* 381
    var. *typicum* 381
  palustre 382
  pannosum 363
  parviflorum **353**
    var. *vestitum* 353
  philippinense 362
  prainii 382
  pseudobscurum **380**
  reticulatum 350
  rhynchospermum **368**
  roseum? 376
  roseum var. *anagallidifolium* 380
  roseum var. *cylindricum* 355
  roseum var. *dalhousieanum* 358
  roseum var. *indicum* 358
  royleanum **358**
    forma **glabrum** **361**
    forma **glandulosum** **360**
  royleanum 357
  sadae 369
  sericeum 328, 352
  sikkimense **372**
    subsp. **ludlowianum** **373**
  soboliferum **375**
  souliei 366
  speciosum 349
  spicatum 346
  squamosum **380**
  staintonii **354**
  stracheyanum **368**
  stracheyanum (cf.) 379
  subnivale 369
  sykesii **366**
  tetragonum 357, 365, 367, 382
  tetragonum var. *amplectens* 369
  tianschanicum 355
  tibetanum **357**
  tomentosum 352
  trichoneurum 362
    var. *brachyphyllum* 361
  trichophyllum **374**
  trilectorum **374**
  vestitum 353
  wallichianum **365**
    subsp. **souliei** **366**
  wattianum **377**
  williamsii **378**
Eucamptodontopsis pilifera **39**
Eurhynchium campylocarpum **63**
  pulchellum **63**

Fabronia andina **62**
FABRONIACEAE 62
Fissidens asplenioides **51**
  elegans **38, 51**
  kegelianus **37**
  leptopodus **38**
  mollis **37**
  muriculatus **38**
  pellucidus **38**
  polypodioides **38**
  pseudorepandus **37**
  radicans **38**
  repandus **51**
  similiretis **38**
FISSIDENTACEAE 37, 51
Funaria hygrometrica **57**
  suberecta **57**
FUNARIACEAE 57

Glossadelphus **laevifolius** **49**
  longisetus 49
Goniopteris aristata 281
Good, R. 203–226
Grammitis **147**
  attenuata **147**
  attenuata 149
  beddomeana 147
  involuta 142
  medialis **149**
  reinwardtii **153**
  wallii **152**
  zeylanica **152**
Grimmia affinis **57**
  fusco-lutea **57**
  rivulariopsis **57**
GRIMMIACEAE 57
Groutiella apiculata **42**
  husnotii **42**
  mucronifolia **42**
Gymnogramme lanceolata 142
Gymnopteris decurrens 140
  metallica 141
  spicata 139, 140
  variabilis 140
  wallii 141

Haplodontium diplodontium **57**
  jamesoni **57**
Harpophyllum aureum **47**
HEDWIGIACEAE 42
Hemidictyum brunonianum 317
Hemionitis esculenta 310
Himalaya, Allium and Milula in the central and eastern 159–191
  Saxifraga of the 83–129, 227–260

Himalayan region, The genus Epilobium in the 325–382
  New species of Taraxacum from the 261–273
Himalayan species of Pedicularis, New 1–34, 383–384
Homalia glabella **43**
Hookeria acutifolia **45**
HOOKERIACEAE 44, 62
Hookeriopsis acicularis **46**
  cocoensis 49
  falcata **46**
  falcatula **46**
  guadalupensis **46**
  leiophylla **46**
Husnotiella revoluta **55**
Hymenolepis mucronata 140
  revoluta 139
    var. *planiuscula* 139
Hymenostylium stillicidiorum **53**
Hyophila tortula **40, 53**
HYPNACEAE 49, 64
Hypnella cymbifolia **47**
  filiformis **47**
  leptorrhyncha **47**
Hypnum cupressiforme **64**
HYPOPTERYGIACEAE 48, 62
Hypopterygium tamariscinum **48, 62**

Isodrepanium lentulum **47**
Isopterygium herminieri **49**
  longisetum **49**
  micans **49**
  tenerum **49**
Isopyrum aquilegioides, The identity of 193–202

Lastrea boryana 282
  divisa 282
LEMBOPHYLLACEAE 62
Lepidopilum antillarum **46**
  dominicense **46**
  integrifolium **46**
  mulleri **46**
  polytrichoides **47, 62**
  portoricense **46**
  purpurascens **46**
  radicale **46**
Lepisorus bicolor 138
  nudus 135
Leptochilus **140**
  decurrens **140**
  laciniatus var. *simplex* 140, 141
  lanceolatus 140, 141
  metallicus **141**
  thwaitesianus **141**
  wallii **141**
  zeylanicus 140, 141
Leptodontium acutifolium **54**
  acutissimum **54**
  densifolium **54**
  filiforme **54**
Leptodontium—*contd.*
  gracile **54**
  stellaticuspis **55**
  ulocalyx **54**
Lepyrodon tomentosus **60**
LEPYRODONTACEAE 60
Lepyrodontopsis trichophylla **48**
Leskea angustata **62**
LESKEACEAE 48, 62
Leskeodon **44**
  andicola **45**
  auratus **45**
  cubensis **45**
  dussii **45**
  longipilus **45**
  mariei **45**
  parvulus **45**
  pusillus **45**
LEUCOBRYACEAE 39, 53
Leucobryum antillarum **39**
  crispum **39**
  martianum **39, 53**
  polakowskyi **39**
Leucoloma albulum **39**
  crugerianum **39**
  mariei **39**
  serrulatum **39**
LEUCOMIACEAE 47
Leucomium attenuatum **47**
  compressum **47**
  robustum **47**
Lilium **paradoxum** **78**
Lindigia aciculata **61**
  debilis **61**
Loxogramme **141**
  involuta **142**
  lanceolata 141
  parallela **141**

Macromitrium cirrosum **42**
  crispatulum **60**
  dubium **42**
  laevisetum **60**
  longifolium **60**
  perichaetiale **42**
  scoparium **42**
  serrulatum **60**
Meiothecium boryanum **48**
Merceya ligulata **53**
METEORIACEAE 43, 61
Meteoriopsis patula **61**
  remotifolia **43, 61**
Meteorium *auricosta* 43
  illecebrum **61**
Microdus **rubrisetus** **52**
Microsorum **142**
  alternifolium 144
  dilatatum **143**
  hancockii 143
  membranaceum **142**

Microsorum—*contd.*
nigrescens **144**
pteropus **143**
punctatum **143**
scolopendria **143**
Microstegia aspera 306
dilatata 303
esculenta 310
marginata 306
polypodioides 306
sylvatica 301
Mielichhoferia andina **57**
campylocarpa **57**
longiseta **57**
nana **57**
Milula **189**
spicata **189**
Mittenothamnium reptans **49, 64**
MNIACEAE 59
Mnium longirostrum **59**
Molendoa andina **53**
Morinia **ecuadorensis** **55**

Neckera andina **61**
jamesoni **61**
lindigii **61**
obtusifolia **61**
NECKERACEAE 43, 61
Neckeropsis disticha **43**
undulata **43, 61**
Nephrodium aristatum 281
boryanum 282
divisum 282
otaria 281
New Guinea, On the geographical relationships of the angiosperm flora of 203–226
Niphobolus adnascens 133
ceylanicus 133
fissus 134
gardneri 134
mollis 134
pannosus 135
sticticus 134
Nothoscordum inodorum 180
sulvia 179
Novitates Himalaicae 65–81

Octoblepharum albidum **39**
Orthostichopsis auricosta **43**
ORTHOTRICHACEAE 42, 59
Orthotrichum elongatum **60**
undulatum **60**

Papillaria deppei **43**
imponderosa **61**
laevifolia **61**
nigrescens **61**
Paraleptochilus decurrens 140
Parathyrium boryanum 282
Paris **marmorata** **79**
Pedicularis, New Himalayan species of 1–34, 383–384
Pedicularis alaschanica **31**
albida 31
albiflora **31**
angustiloba 25, 31, **384**
atroviridis 13, 31, **383**
bella **6**, 31
var. *holophyllv* 6
var. *typica* 6
bicornuta **31**
bifida **31**
branchiophylla 4
canescens 16, 32, **384**
cheilanthifolia **31**, 32
cheilanthifolia 28
clarkei **32**
collata **32**
confertiflora **32**
corydaloides **32**
cryptantha **4**, 32
daltonii **32**
densispica **20**, 32
var. *schneideri* 20
denudata **32**
diffusa **29**, 32
elephantoides **32**
elliotii 13, 32, **383**
elwesii **32**
excelsa **32**
filiculiformis 5, 32, **383**
fletcheri **384**
fletcheriana 19, 32, 384
furfuracea **32**
garnieri **32**
gibbera **32**
gracilis **32**
heydei **32**
hicksii 10, 32, **383**
hookeriana **32**
imbricata 24, 32, **384**
integrifolia **32**
inconspicua 17, 32, **384**
kansuensis **30**, 32
klotzschii **32**
kongboensis 25, 32, **384**
lachnoglossa **32**
latituba **32**
longiflora **7**, 32
subsp. *tubiformis* 7
longipedicellata 8, 32, **383**
ludlowiana **384**
ludlowii 14, 32, 384
lyrata **32**
megalantha **32**
megalochila **7**, 32
merrilliana **33**
microcalyx **33**
mollis **33**
mucronulata 23, 33, **384**

Pedicularis—*contd.*
  multiflora 22
  muscoides **33**
  mychophila **33**
  nana **33**
  nepalensis **6**, 33
  oederi **4**, 33
  oliveriana **22**, 33
  pantlingii **33**
  pectinata **33**
  perpusilla 9, 33, **383**
  petelotii 27, 33, **383**
  platychila 24, 33, **384**
  plicata **28**, 33
  poluninii 15, 33, **384**
  polygaloides **33**
  porrecta **33**
  porriginosa 21, 33, **384**
  przewalskii **6**, 33
    var. *australis* 6
  pseudoregeliana 11, 33, **383**
  punctata **33**
  pycnantha **33**
  pyramidata **22**, 33
  regeliana **33**
  reptans 15, 33, **384**
  retingensis 26, 33, **384**
  rhinanthoides **33**
  rhizomatosa 9, 33, **383**
  rhynchotricha 21, 33, **384**
  robusta **33**
  roylei **29**, 33
    var. *cinerascens* 29
  schizorhyncha **34**
  sculleyana **34**
  shawii 29, 34, **384**
  sherriffii 12, 34, **383**
  siamensis 28, 34, **384**
  sikkimensis **34**
  siphonantha **7**, 34
    var. *prostrata* 7
  sp. near P. aloensis **34**
  sphaerantha 16, 34, **384**
  stenotheca 30, 34, **384**
  stewartii **34**
  subulatidens 20, 34, **384**
  szetschuanica **30**, 34
    var. *angustifolia* 30
  takpoensis 5, 34, **383**
  tantalorhynchoides 11, 34, **383**
  tatsiensis **34**
  tayloriana **383**
  taylorii 10, 34, 383
  tenuirostris **34**
  trichoglossa **34**
  tubiformis 7
  umbelliformis **34**
  wallichii **34**
  xylopoda 18, 34, **384**
Phegopteris kingii 282
Philonotis glaucescens **41, 59**
  gracillima **41**
  rufiflora **59**
  scabrifolia **59**
  sphaericarpa **41, 59**
  uncinata **41**
PHYLLOGONIACEAE 43
Phyllogonium fulgens **43**
Phymatodes nigrescens 144
  oxyloba 145
  scolopendria 144
Pilopogonella laevis **53**
PILOTRICHACEAE 44, 62
Pilotrichella flexilis **43**
  hexasticha **43**
Pilotrichidium antillarum **44**
Pilotrichum bipinnatum **62**
  compositum **44**
  hahnianum **44**
  herminieri **44**
  husnotii **44**
Pinnatella pinniformis **43**
Pireella cavifolia **43**
PLAGIOTHECIACEAE 48
Pleocnemia aristata 281
Pleopeltis **135**
  amaurolepida **136**
  bicolor **138**
  dilatata 143
  ensifolia 139
  excavata **138**
  hastata 145
  lanceolata 139
  lepidota 139
  linearis 135
  macrocarpa **139**
  marginalis 139
  membranacea 142
  nigrescens 144
  nuda **135**
  oxyloba 145
  phymatodes 144
  pteropus 143
  punctata 143
  wightiana 135
Pleuropus leskeoides **63**
Pogonatum obscuratum **64**
  oligodus **64**
  tortile **49**
Pohlia papillosa **58**
Polypodiaceae and Grammitidaceae of Ceylon, The 131–158
Polypodium alternifolium 143
  beddomeanum 153
  contiguum 157
  cornigerum 154
  corticola 155
  cucullatum 154
  decorum 155
  dilatatum 143

Polypodium—*contd.*
euryphyllum 143
excavatum 138
var. *bicolor* 138
gardneri 134
gladiatum 136
glandulosum 155
hancockii 143
hirtellum 153
khasyanum 157
lanceolatum 139
lasiosorum 153
lepidotum 139
linnei 144
macrocarpum 139
marginale 139
mediale 149
membranaceum 142
moultonii 155
nigrescens 144
nudum 135
obliquatum 156
oxylobum 145
pannosum 135
parasiticum 147, 149
phymatodes 143
porosum 134
pteropus 143
quercifolium 144
repandulum 156
scolopendria 143
sparsisorum 144
subfalcatum 156
subminutum 156
subtripinnatum 282
thwaitesii 155
trifidum 145
wallii 152
wightianum 135
zeylanicum 152
POLYTRICHACEAE 49, 64
Polytrichadelphus aristatus **64**
Polytrichum juniperinum **64**
Porotrichodendron nitidum **62**
superbum **62**
Porotrichum insularum **44**
korthalsianum **62**
longirostre **62**
Potentilla arbuscula **67**
var. **unifoliolata** **67**
bhutanica **68**
POTTIACEAE 40, 53
Prionodon densus **60**
fusco-lutescens **60**
luteovirens **60**
patentissimus **60**
pinnatus **60**
PRIONODONTACEAE 60
Prosaptia **156**
alata **157**
Prosaptia—*contd.*
contigua **157**
emersonii 157
khasyana **157**
obliquata **156**
PTEROBRYACEAE 43, 61
Pterobryum angustifolium **43**
densum **61**
Pterogonidium pulchellum **48**
Pyrrosia **133**
acrostichoides 134
ceylanica **133**
gardneri **134**
lanceolata **133**
mollis **134**
pannosa **135**

Rauia teretiuscula **62**
Raven, P. H. 325–382
Rhacocarpus humboldtii **42**
Rhacomitrium crispulum **57**
RHACOPILACEAE 60
Rhacopilum tomentosum **60**
Rhamphidium dicranoides **40**
Rhaphidostichum schwaneckianum **48**
RHIZOGONIACEAE 41
Rhizogonium spiniforme **41**
Rhodobryum beyrichianum **58**
grandifolium **58**
Rhynchostegiopsis flexuosa **47**
Rhynchostegium inerme **63**
lamasicum **63**
Saussurea **chrysotricha** **70**
linearifolia **72**
platyphyllaria **73**
Saxifraga of the Himalaya 83–129, 227–260
Saxifraga **85, 229**
grex **Cinctae** **230**
grex *Densifoliatae* 231
grex Gemmiparae **249**
grex Hirculoideae **231**
grex Melanocentrae **229**
grex Sediformes **252**
grex Sibiricae **259**
grex *Stellariifoliae* 231
grex *Turfosae* 231
sect. *Boraphila* 229
sect. Hirculus **230**
sect. Kabschia **83**
sect. Micranthes **229**
sect. *Nephrophyllum* 259
sect. Saxifraga **259**
sect. *Tetrameridium* 86
afghanica **128**
alpigena **97**
anadena **258**
andersonii **124**
anisophylla **259**
brevicaulis **102**
brunneopunctata **257**

Saxifraga—*contd.*
buceras . . . **109**
calcicola . . . **118**
calopetala . . . **233**
chionophila . . . 90
cinerea . . . **128**
clivorum . . . **122**
contraria . . . **252**
  forma **rubella** . . . **254**
decora . . . **122**
decussata . . . 89
deminuta . . . **242**
doyalana . . . **118**
duthiei . . . 94
elliotii . . . **109**
erinacea . . . **250**
excellens . . . **230**
flavida . . . **108**
georgei . . . **95**
glabricaulis . . . **241**
gouldii . . . **249**
  var. **eglandulosa** . . . **249**
granulifera . . . **259**
haematochroa . . . **248**
heteroclada . . . **244**
  var. **aurantia** . . . **245**
hypostoma . . . **103**
imbricata . . . 105
implicans . . . **231**
isophylla . . . **247**
kansuensis . . . 94
kongboensis . . . **113**
kumaunensis . . . **106**
lamarum . . . **120**
lepida . . . **239**
lepidostolonosa . . . **240**
lhasana . . . **255**
  var. **decapitulata** . . . **257**
likiangensis . . . 91
lilacina . . . 93
lolaensis . . . **105**
lowndesii . . . **106**
ludlowii . . . **113**
matta-florida . . . **105**
matta-viridis . . . **243**
meeboldii . . . 93
micans . . . **126**
mira . . . **114**
miralana . . . **254**
monantha . . . **94**
montana . . . **237**
  forma **rubra** . . . **237**
montanella . . . **238**
mundula . . . **116**
nambulana . . . **108**
namdoensis . . . **237**
nana . . . 89
octandra . . . 89
palpebrata . . . 241
palpebrata var. *elliptica* . . . 241

Saxifraga—*contd.*
  palpebrata var. *parceciliata* . . . 241
  poluniniana . . . **114**
  pulchra . . . 93
  pulvinaria . . . **105**
  quadrifaria . . . 89
  ramulosa . . . 94
  ramulosa . . . 95
  rhodopetala . . . **124**
  roylei . . . **95**
  rubriflora . . . **229**
  rupicola . . . 90
  saginoides . . . 243
  saginoides var. *parvipetala* . . . 243
  saxatilis . . . 92
  saxicola . . . **116**
  saxorum . . . **103**
  schneideri . . . **103**
  serrula . . . **252**
  sessiliflora . . . **102**
  sherriffii . . . **120**
  sphaeradena . . . **235**
    subsp. **dhwojii** . . . **236**
  staintonii . . . **118**
  stella-aurea . . . 254
    var. **polyadena** . . . **254**
  stolitzkae . . . **129**
  subsessiliflora . . . 90
  subternata . . . **97**
  taylorii . . . **247**
  thiantha . . . **111**
    var. **citrina** . . . **113**
  tigrina . . . **233**
  unguipetala . . . 93
  vacillans . . . **98**
  virgularis . . . **246**
  williamsii . . . **100**
Scleroglossum . . . **157**
  sulcatum . . . **157**
Scolopendrium dubium . . . 295
SEMATOPHYLLACEAE . . . 48, 63
Sematophyllum adnatum . . . **48**
  caespitosum . . . **46, 63**
  cuspidiferum . . . **63**
  subsimplex . . . **48**
Sledge, W. A. . . . 131–158, 275–323
Smith, H. . . . 83–129, 227–260
SPLACHNACEAE . . . 57
Splachnobryum julaceum . . . **40**
  mariei . . . **41**
  obtusum . . . **40**
  wrightii . . . **40**
Squamidium caroli . . . **61**
  leucotrichum . . . **43**
  nigricans . . . **43, 61**
Stearn, W. T. . . . 159–191, 193–202
Stereophyllum cultelliforme . . . **48**
Streptopogon erythrodontus . . . **56**
  rigidus . . . **56**
Syrrhopodon husnoti . . . **40**

Syrrhopodon—*contd.*
  lycopodioides **40**
  prolifer **39**
  rigidus **39**
  tenuifolius **40**

Taeniopsis falcata 157
  sulcata 157
Taenitis revoluta var. *planiuscula* 139
Taraxacum from the Himalayan region, New species of 261–273
Taraxacum **bhutanicum** **263**
  chitralense **264**
  dasypodum **265**
  forrestii **265**
  glaucophyllum **266**
  himalaicum **267**
  hooftii **267**
  karakoricum **268**
  kashmirense **268**
  lanigerum **269**
  ludlowii **269**
  mucronulatum **270**
  nepalense **271**
  pseudostenoceras **271**
  sherriffii **272**
  staticifolium **272**
Taxiphyllum planissimum **64**
Taxithelium planum **48, 63**
  portoricense **49**
Tayloria scabriseta **57**
THUIDIACEAE 62
Thuidium antillarum **48**
  cylindricum **62**
  delicatulum **63**
  peruvianum **63**
  pseudodelicatulum **63**
Tortula aculeata **56**
  bogotensis **56**
  caroliniana **56**
  denticulata **56**
  fragilis **57**
  pichinchensis **57**
Trematodon humilis **52**
  tenellus **38**
Trichomanes contiguum 157
Trichosteleum brachydictyon **48**
  ptercladium **48**
  vincentium **48**
Trichostomum aequatoriale **54**
  bellii **54**
  cylindricum **53**
Tsoong, P. C. 1–34, 383–384

Van Soest, J. L. 261–273
Vesicularia amphibola **49**
  vesicularis **49, 64**
Vittaria sulcata 157

Weisia jamaicensis **40**

Xiphopteris **154**
  cornigera **154**

Zygodon fasciculatus **59**
  goudotii **59**
  pichinchensis **60**
  reinwardtii **59**
  stenocarpus **59**
  subsquarrosus **59**

BRITISH MUSEUM [illegible] NATURAL HISTORY

PRINTED IN GREAT BRITAIN BY
ADLARD AND SON, LIMITED
BARTHOLOMEW PRESS, DORKING